June 1971

Smithsonian

Painter Waldo Peirce at home—from the intimate memorabilia in the Archives of American Art, p. 52

This summer, take a vacation where there's more to share than just scenery.

In Florida.

Or the Caribbean.

Where the feeling and the things to share are not at all like back home. Where the memories you bring back are different, too.

Like fishing off the Virgin Islands.

To you, it's the memory of sharing that first day of deep-sea fishing. Your son and you together.

To your son, it's the fishing. Mostly, though, it's his memory of his question: "Dad, will the mommy fish be sad if I catch her baby fish?"

And your answer: "No, mommy fish don't love their children as much as your mother loves hers."

And his thought: "Am I glad I'm a boy and not a fish!"

Or another memory, the Kennedy Space Center in Florida.

To your kids, it's remembering and thinking about rocketing off to outer space. When they're older.

To you, it's remembering and thinking about Sunday mornings with Buck Rogers. When you were younger.

Or the memories of a moment in Jamaica.

To your daughter, it's not just rafting down the Rio Grande in Port Antonio that's the memory.

To her, it's you taking over the raft and rafting like she was positive you could.

It's the incredibly soft voice of an incredibly huge man, the Jamaican raft captain.

"Mon, you raft good. Sure you don't raft before?"

And you, on the same raft ride.

To you, it's taking over the raft and looking good to your audience. At least you didn't fall in.

It's how close you felt. How you wanted to deep-freeze that moment of loving and sharing and save it forever.

Which you did. With your memory.

There's plenty to share in Florida, Puerto Rico, Jamaica, the Bahamas, Bermuda, the Virgin Islands, Curaçao and Mexico.

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June 1971

Smithsonian

Volume 2, Number 3

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The view from the castle

Too often there's little fun in school; but education has many facets, such as museums, that can make learning a joyous process

"Older people are always asking me what school is like," my daughter said to me the other day. "What do they think—that it's groovy?"

Schools constitute the main primary source for the transmission of skills and knowledge. They should also transmit a sense of values and encourage the ability to learn totally—not just through cognition. Yet, as my daughter pointed out, school is all too often no fun. Teachers have to fall back on discipline. They set up rigid schedules of "work" periods and "play" periods. Thus learning becomes all work, and fun flies out the window.

The very word "education" is now beginning to resemble a deep sand trap in a golf course. We are all stuck in it, trying our best to get out with our various-shaped irons. Defenders of today's education (those thinning ranks!) still believe that conventional tools eventually will get us to the green. Radicals claim that all is lost and that we would do better to pick up the ball and head for the 19th hole.

There is little doubt that the basic machinery for transferring information has not failed. The docile student in a university who accepts higher authority can receive highly adequate training in a multiplicity of skills. But there are many not-so-docile university students who tend to confuse authority with power. This can be a dangerous mistake, for authority is always part of the transmission process in teaching, while power is necessary only when the function from which it derives has been weakened. No educator can depend successfully on power alone, but his authority certainly should create an appropriate allegiance.

Educators at all levels should realize that they belong not to an elite, but to the whole mixed-media scene. Schools affect lives just as do churches, libraries, newspapers, plays, magazines, concerts, books, lectures, museums and the great out-of-doors. Yet too many educators think of all these other things as part of recreation—life's "play period" if you will. Somehow they are all ancillary to the real world and dangerous to the digestion like sweets taken in large doses. After all, say the old-line teachers, education is serious business, costing billions of dollars. It can't be fun. You can't demand money for *fun*.

In truth, educators are not members of a special, sober-sided club. One of many facets of their field is the museum—about which we at the Smithsonian Institution can claim some expertise. As I said in a recent book, museums today are hideously understaffed and underfinanced. They are a well-established part of the educational process, a part that is free to the individual and taken for granted and full of endless services just for the asking. But they cannot possibly meet the demands made on them by the public and by our school systems.

It has always seemed almost immoral to suggest that museums need help to do what they do—that is, create a learning environment that turns out to be fun. Yet if education in its broadest sense is to survive, we will have to come to grips, finally, with the fact that museums are a part of it. No longer should they be regarded as some isolated and curious ethnic subculture and left to drown in the mindless, homogenized sea around them.

S. Dillon Ripley

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Letters to the Editor

John Cabot

Dear Sir: Professor Morison's great account of John Cabot's voyage of discovery raises a question: How is it that on Cape Breton, on a beach where we hiked a few summers past, there is a memorial marker signifying that it was there that Cabot first landed? Having grown up in Massachusetts, where Lexington and Concord are each still claiming to be the birthplace of the Revolution, I can understand local rivalries. But do the Cape Breton people have anything to go on?
Mrs. Eugene Johnson
Washington, D.C.

In his notes to the chapter on Cabot which SMITHSONIAN *excerpted from Professor Morison's new book,* The European Discovery of America, *he says: "It is hardly worthwhile to mention all the arguments for the Cape Breton landfall, now rendered untenable by information contained in the Day letter." The letter from John Day, Cabot's contemporary, probably to Columbus, reports very precise navigational data for Cabot's voyage, and it is reprinted in Professor Morison's book.* Ed.

White tigers

Dear Sir: Your article on white tigers in the April issue includes a technical error. Your diagram caption writer states: "Family tree of the world's known white tigers illustrates how inbreeding makes white-coat genes dominant."

If it were true that the white-producing genes have become dominant, these white tigers could be bred with normal wild types and the white coats would be the

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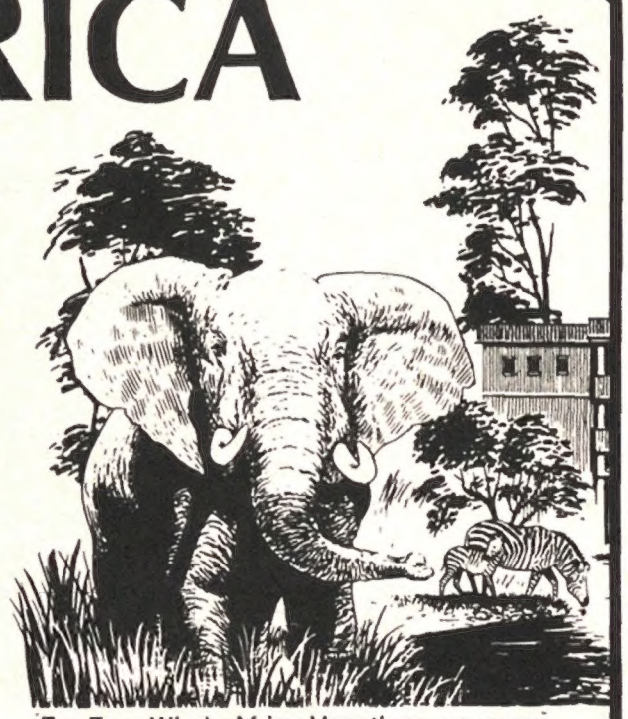

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ones to show in the first-generation offspring. The white-coat genes are still as recessive as ever. The breeders have not caused the white-producing genes to become *dominant* but *isolated,* thus creating a pure breeding strain, all members of which carry the same recessive gene.
John W. Kirk
Eugene, Oregon

Dear Sir: Unless tigers have learned some fascinating new trick of genetics, the recessive white gene does not become dominant in the white tiger. They merely become homozygous for the recessive white-coat color gene.
Gilbert M. Slater
Newfield, New Jersey
Both Mr. Kirk and Mr. Slater are correct. Coauthor Leyhausen had brought this to our attention, and Theodore Reed agrees that "you were caught with your genes down." Ed.

Dear Sir: An additional fact: Chairman John W. Kluge of Metromedia donated Mohini, Washington's first white tiger.
Mark Evans
Washington, D.C.
The article's theme was genetics, not single acquisitions. Ed.

Computer revolution

Dear Sir: The article in the April SMITHSONIAN, "We've seen nothing yet as the real computer revolution looms up ahead," is the first serious suggestion I have seen that a self-programming computer is likely to be developed before the end of the century.

2001: A Space Odyssey was not, however, the first fictional public presentation of such a creation. Robert A. Heinlein in *The Moon is a Harsh Mistress* envisioned a similar entity in Mycroft Holmes, a "High-Optional, Logical, Multi-Evaluating Supervisor, Mark IV, Mod. L—a Holmes Four." Not only does Mike have superb intelligence and explicitly stated self-programming capability, but also a sense of humor and literary inclinations, two humanizing characteristics HAL lacks. Isaac Asimov in the seventh story in *I, Robot,* titled "Escape!", describes another humorous thinking machine, The Brain, which is also implicitly self-programming.
G. R. Puro
Geneva, New York

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Earth

Dear Sir: In regard to Isaac Asimov's article on one of the Greeks' four universal elements, Earth, I am curious about one of your illustrations—the cylindrical periodic table of the elements. Of course, it *could* be American even if it were in Chinese, but the "Kohlenstoff" on the cylinder looks suspiciously German.
Lloyd F. Ryan
Arlington, Virginia
The cylindrical periodic table is indeed in German. It was brought from Germany by a German professor, to the University of Wisconsin, where he used it as a teaching aid. The University gave it to the Smithsonian. Ed.

Dear Sir: In Isaac Asimov's admirable article, I was amazed to find that only Dmitri I. Mendeleev is mentioned as creator of the periodic system of elements. As an alumnus of the antiquissima Universitas Carlos-Ferdinandea Pragensis (class of 1911), I remember that the priority concerning the periodic system was attributed to Julius Lothar Meyer.
Karl Wolfgang Ascher, M.D.
Cincinnati, Ohio
Mendeleev is generally credited with the development of the periodic table although Meyer, working independently, published his work in the same year, 1869. Both he and Mendeleev shared the Davy medal in 1882 for their work on the periodic table. Ed.

Folk art

Dear Sir: I was absolutely fascinated and astounded when I saw William Fellini's *Lily in Boot* (SMITHSONIAN, February). Our family knew Mr. Fellini for over 25 years, as he used to do interior painting for my mother until she moved away.

Without a doubt he was one of the nicest and kindest of men. He could not sell one of his pictures during his lifetime, and Mother felt so sorry for him that she tried to give him work. The murals in the Pen & Pencil restaurant in New York were done by Mr. Fellini. He never lived to receive recognition and fame, since he died six years ago in Brooklyn; in fact, my mother helped with his burial expenses.
Nanette Bayne Turner
Arcadia, Florida

Golf

Dear Sir: In reference to Patrick Ryan's article, "Let's harness the energy that golf wastes," I suggest that before he tries another pseudo-scientific parody, he first learn more basic physics.

Basing his calculations on a value of four horsepower per tee shot, Mr. Ryan determined that approximately 70 horsepower are "squandered" by the average golfer playing 18 holes of golf. I should like to point out that "horsepower" (as its name implies) is a unit of power, *i.e.* energy expended per unit time, and as such *cannot* be calculated over 18 holes of golf but rather remains constant at the stated value of four horsepower for each hole. On the other hand, the *energy* expended per hole *can* be summed up over an 18-hole round of golf. Thus for 18 holes, allowing roughly one-quarter second duration for each tee shot, the average golfer expends approximately 0.0037 kilowatt-hours of energy—enough energy to power a 60-watt light bulb for approximately four minutes, or in monetary terms, approximately 0.01 cents ($0.0001) of electricity.
Donald Zolotorofe
Ithaca, New York

Dear Sir: A 49-watt light bulb, dimmed by whatever energy is imparted to the ball, is the best that Ryan's duffer does swinging—certainly not his 70 horsepower or 52,200 watts. Further, Ryan equates golf with "watching all the girls go by." For shame! Even elderly Irishmen generate far, far more than 49 watts. And "fiddling on putting greens" and "just standing around" costs 108 kilogram calories an hour. Ryan's other caloric values are correct.
A. Edward Ward
Lowell, Michigan

Dear Sir: Our good magazine cannot be that hard up for material that we have to waste a page on Mr. Ryan's pointless, unfunny article aimed at the only good pleasure times a lot of us have. May he

Afrique.

Questions and answers

1 "What's the difference between Africa and Afrique?"

Afrique is the best of Africa: the exotic French and English-speaking nations along Africa's lush West Coast. Afrique is also the part of Africa that's closest to the U.S. It costs much less to get there and back than to the remote East Coast; yet the jungle is just as exotic, the food and climate are much better, and the cities are among the world's most cosmopolitan.

2 "What language do I need to know if I'm traveling through Afrique?"

Surprisingly enough, English is spoken with great frequency in most of the major cities. If your English isn't good, then a year or two of high school French will stand you in good stead. French is the major language in most of the places we fly to. So if you don't "parlez-vous Ouolof", don't worry about it. There are over 100 Africain dialects. And not even the Africains can master them all.

3 "When is the best time to plan a trip to Afrique?"

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See the LIFE Magazine edition of April 26, 1968, for a photographic essay on Gardiner's Island.

continue to "slice" with his typewriter.
J. R. Oxenreiter
Pittsburgh, Pennsylvania

Dear Sir: I am curious how Mr. Ryan arrived at four horsepower for the hitting power of a tee shot.

1 HP = 550 ft. lb. per second
Assume: 0.1 sec. per stroke
3-foot-long club
360-degree swing
$\pi = 3.33$ (for convenience)
Club head = 0.5#
Hence: Diam. of swing = 2 x 3 ft. = 6 ft.
Circumference of swing = $6\pi = 20$ ft.

Then: $\frac{20 \text{ ft.} \times 0.5\#}{0.1 \text{ sec}} = 100 \text{ ft.}\#/\text{sec}$

$\frac{100 \text{ ft. }\#/\text{sec}}{550 \text{ ft. }\#/\text{sec/HP}} = \text{less than } 0.5 \text{ HP}$

Did Mr. Ryan by any chance miss a decimal point?
Walter E. Allan
Howey-in-the-Hills, Florida

Dear Sir: Patrick Ryan's article makes the ever-popular error of beginning with a nonsense premise. Running, he says, consumes 679 calories an hour and walking takes up 334, while golf, "with all that idling," burns up a mere 223. Therefore, we are led to believe that a nice hour's walk is far more healthful. This might be true if one played golf for only an hour. Very few people play four-and-a-half holes of golf, which takes approximately an hour, and many people are known to spend four hours playing 18.
John C. Stevens
Fort Worth, Texas
Calculators (above) seem to take different points of departure. Even modest Mr. Ryan says: "Dodging similar brickbats from other physicists, I suggest that, pending invention of magic horsepower accumulator, golfers will just have to be content with lighting up the odd traveling circus. I trust that the erudite nobility will continue the courtly tradition of showing compassion and I will avoid calculations in the future." Ed.

Invitation to 'Adventure'

Date: Sunday, June 13

Time: 10:00 to 11:00 P.M., 9:00 P.M. Central Time

Place: CBS Television

"Smithsonian Adventure" is the name of a new documentary television series. The Smithsonian is working closely with a talented CBS-News group to produce it. The CBS team is headed by two distinguished producers, Burton Benjamin and Isaac Kleinerman, and the narrator-host will be the former astronaut, Wally Schirra. The subjects will be as varied as the Institution, the content we hope always challenging, informative and highly interesting.

The first show, on June 13, will be called, "The Search For The Goddess of Love." Filmed in Europe and the Near East, it deals with a questing and questioning science, archaeology. We could describe it as a true-life thriller in breathtaking color. We won't, but we hope you will after you see it.

This invitation, you will note, does not carry the usual RSVP—but if you do want to comment afterwards please address your letter to Frederic M. Philips, Director of Public Affairs, at the Smithsonian in Washington. We'd be happy to know any thoughts you have about this new Institutional effort, in cooperation with a top television network, to serve the National Associates and the general public throughout the country.

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Stretching 289 miles, over mountains and under rivers, the pipeline brings energy to the heart of Europe.

To get things going, Trieste had to be turned into a deep-water port to receive giant tankers. Rights-of-way had to be negotiated with thousands of individual landowners. Fifty major contracts of half-a-million dollars or more had to be worked out. And forty companies were involved in construction.

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But what impresses us most has nothing to do with money. In our view, the transalpine pipeline is a remarkable example of how different governments, different people and different businesses can get together. Settle their differences. Solve their mutual problems. And get a huge job done without unduly disturbing the good things of earth.

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Esso

Right after the earthquake hit, Skopje's downtown shopping district looked like this.

Today, streets and structures are rebuilt. Note the same building in the background.

By Wendy V. Watriss

Skopje: the planners' dream city rises from earthquake rubble

Nature leveled this Yugoslavian town; worldwide skills, humanity and teamwork are moving it to an enviable future

At 5:17, eight years ago on the morning of July 26, a city found itself at the threshold of extinction: 170,000 of its people homeless, more than 1,000 dead and 4,000 injured, its schools and hospitals demolished, three-fourths of its social area destroyed. Without warning, an earthquake had wiped away the work of centuries leaving in its wake mounds of brick and broken stone, jagged fissures, a child's notebook in the dust, a trail of blood along the cobblestones. Skopje lay in ruins.

Twenty years ago, Skopje was a small, historic trading town in the Macedonian (southeastern) region of Yugoslavia. Its population was largely illiterate; it had no codified language, a handful of secondary schools, one faculty of higher education and an old tobacco factory. By 1963, it had become one of the fastest-growing cities in the world, and the third largest in Yugoslavia with a full-scale university system and major industrial complexes. Then, in less than 20 seconds, it was mostly rubble.

Today the outline of a new city rises over the gravestones. Years of struggle had inured the citizens to the malignities of fate and, even as tremors continued and families buried their dead, they argued against moving elsewhere. Survivors who remained worked in tents by lantern light. Bit by bit, 100,000 evacuated women and children came back to their darkened streets.

Skopje's determination to survive found support everywhere. In Yugoslavia, long-standing cultural animosities were set aside as Serbs, Croats, Slovenes, Bosnians and Montenegrins as well as Macedonians answered President Tito's call for the creation of a special reconstruction fund. Foreign governments rushed supplies and manpower to the city and sent teams of geologists, engineers, architects and urban planners.

When Macedonian officials met within days of the earthquake to organize reconstruction, they had two choices: Let the city straggle back to its former self, vulnerable to natural disaster and urban slum, or transform it into a new city, able to meet modern technological challenges. The former meant quick restoration of familiar living patterns; the latter meant extended hardship and risk. With years of sacrifice behind them and the prospect of international support before them, Macedonians chose the future.

Skopje asked for the best possible help in planning a new city, and the U.N. General Assembly voted to comply with Yugoslavia's request for technical expertise in long-range urban planning and seismic engineering through the U.N. Development Programme. By early 1965, 77 countries had made donations in capital investment, including schools, hospitals, building materials and prefabricated housing, and a U.N.-Yugoslav project for development of a long-range urban reconstruction plan was well under way. The fast-growing, rather provincial-minded city became a gathering place for some of the world's finest minds in the field of environmental planning.

Today, a stranger entering Skopje and expecting to see a crumbling city is surprised. Superficial scars are few: some empty places around the main square, diagonal patches along the sides of houses, the jagged wall of Turkish *djamija* in the old quarter, the ruined rail-

A youthful veteran of film and magazine writing and photography, Wendy Watriss has lived and studied in Europe. The color photographs are hers.

way station whose clock has stopped at 5:17—a monument to the past. Otherwise the city is vibrant with life. Fiats, Renaults and Volkswagens skim along freshly macadamized roads, while pantalooned peasant women shop alongside miniskirted students in new supermarkets. Acres of former farming land are covered by blocks of high-rise apartment houses and prefab rectangular suburbs. At night, green-white rows of mercury-vapor lamps cut through the yellow jumble of old street bulbs, and the flame of a new steel mill glows in the distance.

In the morning, one wakes to the sound of steelworkers framing a shopping center—Skopje's biggest nonindustrial steel structure. A chatter of drills echoes along the Vardar river as workmen carve new embankments. On the left bank, the old *Stara Czarsija* marketplace is a maze of scaffolding as individual plumbing is being installed in more than 1,000 artisan shops. On the right bank, a 12-story apartment house undergoes electronic testing for earthquake resistance. On all sides, the horizon is ringed by construction cranes.

"Is it surprising that we find our future here?" asks Jovan Popovski, a leading chronicler of Skopje's history. "Many people have fought for this city—at the crossroads of the Balkan peninsula. Sixty-four times it has been passed back and forth between its enemies —from ancient Rome to Nazi Germany. Six times it has been leveled by fires and earthquakes. Again and again we have had to leave our homes, but we always come back."

Today people are coming back to a changing world. A 15-year Master Plan is transforming Skopje into a modern industrial city. The plan is a product of many minds with experience in many different social and political environments—from Tokyo to Warsaw.

"In the case of the reconstruction of a city destroyed by natural calamity, as Skopje, or by mankind, as Warsaw, urbanists must be influenced by a pre-existing community," emphasizes Adolf Ciborowski, chief architect for the reconstruction of Warsaw and project manager for Skopje. "This community, regardless of the losses it has incurred, is a fully developed social organism with its own habits and tastes. Unlike a new town, a ruined city cannot be built according to abstract principles. Planners must consider the actual desires of living people."

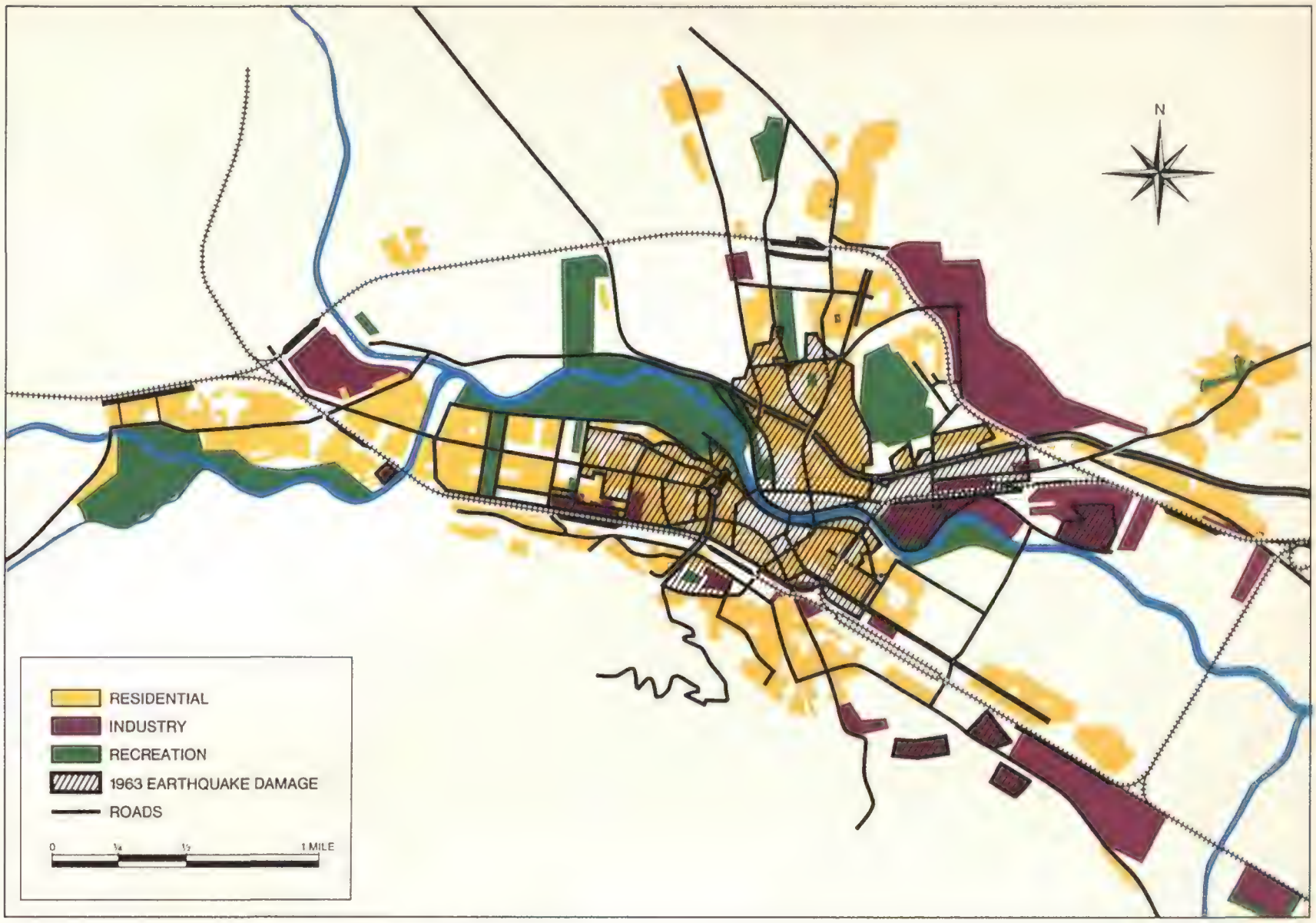
In Skopje, officials and experts had agreed that a modern city should be built in place of the old one, but Skopjans were not accustomed to describing their lives in terms of modern technology. To most, their city is still a large-scale village. Streets are as much a place for social discourse as commercial traffic. Neighborhoods are generally defined by the proximity of friends and the intimacy of personal relationships. Family life is often the center of individual existence, and cultivation of friendship is often more important than material achievement. Time spent with wine and song is traditionally more important than time spent in offices. People are at ease with leisure.

Minority groups guard traditions

This tendency to place human values above technologic progress holds even stronger for Skopje's minority groups. Turks, Gypsies and Albanians account for about 30 percent of the population and are given equal citizenship. They usually have their own schools, theaters and publications. Ingrained attitudes like the Moslem's distrust of secular education or the Gypsy's dislike of steady work have tended to persist in the face of change. Many of these people collect together in communities and preserve traditional lifestyles. Turkish families build walled courtyards around their homes to insure the privacy of women and children. Gypsies prefer a more gregarious existence and let their doors open directly onto the street. However small the rooms and large the family, most homes maintain the customary "white" room for guests.

In Skopje, citizens were exposed to ideas from many lands and worked alongside laborers and engineers from Russia, France, England, the United States, Scandinavia, Poland, Rumania, Japan, Switzerland, West Germany and Bulgaria. They listened to architects and economists. Once work began on the master plan, officials made certain the channels of communication were left open. During the months of work, citizens were encouraged to express their desires and planners were asked to explain their ideas.

The international experts lived and worked with Macedonian architects and planners throughout the entire process. At the same time, a number of Macedonian engineers and planners were sent abroad to



Composite map shows how the heart of Skopje, where much of its urban life was centered, was ruined in July 1963. Today's construction spreads out the city's various (see key) areas.

study on six-month fellowships. The need for interpreters, translators, secretaries and researchers also provided many laymen with unexpected education in techniques of urban planning. "We all learned. Formalities and mannerisms were forgotten; there were no barriers because we were all working for the same thing," remembers one interpreter.

Hardly a day passed that local newspapers and radio programs did not discuss some aspect of the planning process. Local television crews followed most of the work from start to finish. Proposals for housing, education, medical care and transportation were generally debated in open meetings with tenants' committees, teachers, doctors and other professional organizations. "The rooms were often too small for all who wanted to come," another interpreter recalls.

Individual planners were generally stopped several times a day in restaurants, coffee shops or barber shops by people wanting to know what would happen to one part of the city or another. A Polish architect was confronted one morning by a Gypsy housekeeper who told him, "I have been taking care of your house, and now you are responsible for building our houses. You must tell me what they will be like."

Ciborowski explains that interest was strong from the beginning, because it was directly related to survival needs. "People were concerned about what kind of house they were going to get. Then they wanted to know about transportation facilities, because there were so many more motorists after the earthquake. Then they asked about schools and recreational facilities. Finally questions became more general: Are we going to have tall buildings? Will we still have the historical part? Are we going to have a prettier city?"

A number of people were asked to answer these and other questions in a social survey done on ten percent of the city's population—the first study of such wide scope done in Macedonia. The use of sociology as an independent tool is relatively new in many central European socialist societies.

Old streets are torn up to put in plumbing in the historic section of artisan shops.

The survey, carried out by about 200 university students, showed that the city was sharply divided in terms of housing conditions, working skills, income and educational levels. The left bank of the river (see map) contained most of the substandard housing which belonged to minority groups. The majority of Skopje's Slavic population had settled around the newer city on the right bank. Houses on the left bank tended to be one-story, single-family dwellings, while those on the right were newer three- to five-story apartments. The separation of the better-educated Slavs from the poorer, less-skilled minorities was shown to have reinforced cultural isolation.

The survey showed that prefab neighborhoods, originally designed as temporary housing around the edges of the old city, had come to assume a permanent character. Many families quickly took advantage of long-term, low-interest loans, offered by the government, to add extra rooms, balconies and garages to their houses. Welcoming the chance to have a little land, most people had made flower and vegetable gardens around their homes. For most too, it meant the first time they had kitchens and bathrooms with running water. It is hardly surprising that planners found these people as reluctant to move as those among the minority communities.

In regard to housing, the city decided that the only economical way to achieve a uniform improvement in living standards was to restrict future residential development of high-density apartment houses. The basic neighborhood unit would contain 5,000 to 6,000 people with a primary school and various shopping facilities. To give people a greater choice of housing, however, the city increased the amount of land available for single-family homes. It also gave some people an opportunity to build their own settlements in certain areas. So far, the Gypsies are the only group to take advantage of this option. Choosing one of the healthiest land sites, they built a community with schools, supermarket, community center and cultural hall. They feel this development has done much to enhance community responsibility.

For others in substandard neighborhoods, the city inaugurated a slow urban-renewal program. Instead of moving people directly into high-rise apartments, the city gave them single-family prefab houses vacated by others. A special housing fund based on government levies on large-scale building projects subsidized the rents.

A great deal of debate had also centered about the plan for the downtown area. Many citizens felt the prizewinning design, submitted by Kenzo Tange of Tokyo, was better suited to Japan than Macedonia. Tange's designs are often made in accordance with large-scale philosophical concepts. The design for Skopje was based on the concept that cities should be a bridge between the ever-expanding technology of modern civilization and the unchanging factors of human existence. Communication was the keynote of this concept: communication between man and men as well as communication between men and machines.

As originally designed, the new center of Skopje would be an enlarged "vessel" containing the old and the new. The outlines of the vessel would be defined by a massive "city wall" on the north and south, consisting of tall, high-density dwellings with colonnaded malls and shopping facilities. A monumental "city gate" would act as the main entrance to the core of the city. High cylindrical shafts would symbolize a new east-west axis to the city by providing the sole point of vehicular entry for a one-way inner-traffic loop serving the downtown area. The columns would also act as an earthquake-resistant framework for the structure of a new commercial center.

Supermarket in one of the new residential areas stands just across the street from a day-care center.

In peasant dress and modern clothes Skopjans wait and wait for a bus near their new city center.

Both "gate" and "wall" would provide a bridge, as it were, between the scale and speed of machines and the scale and speed of man. Regional and long-distance traffic would be restricted primarily to an outer highway circling the city from one side of the river to the other. The majority of the downtown area would be reserved for pedestrian movement.

Although the final plan has retained the basis of Tange's design, its scale has been considerably diminished in deference to criticism voiced by many Skopjans. In keeping with their love of nature and open space, they eliminated the northern wall so as to allow the natural topography of Kale and Gazi Baba Hills to delineate the features of the older city. The southern wall was lowered and broken up between 12- and 6-story apartment houses which do not conflict with the view of the Vodno Mountains. The size of new buildings on the right bank of the Vardar River was decreased to give greater architectural importance to the arched facades and ceramic rooftops of the small stores and historic monuments around the old *Stara Czarsija*. While most of the commercial and administrative building would be concentrated on the right bank, a major government complex would be divided between both sides of the river.

The traditional north-south axis from the old railway station, down Marshal Tito Street, across the Old Stone Bridge to the market quarter was maintained as the principal pedestrian route over the river. The east-west axis was kept as the main automotive route to the city gate and a new multipurpose transportation center. The height of the gate was reduced, and residential room included alongside office space. Open spaces for walking and resting were required as part of all new building, and new embankments along the river were designed as additional park areas under the tree-shaded banks.

"For us, space is still defined in terms of human movement. A 'human' structure is that which can be approached and used without man having to feel small and insignificant. Man is still the principal element in Skopje; we are not trying to emulate New York or Tokyo," says Tiho Arsovski, now Skopje's chief architect. The expertise learned at Skopje was used to help earthquake-stricken Banja Luka, Yugoslavia, and Chimbote, Peru. These towns have a future, thanks to the veterans who produced the Skopje plan.

In the six years following adoption of the plan, the citizens of Skopje—now nearly 350,000—have been remarkably patient. Numerous families still live in damaged houses without central heating or running water. More than 1,000 tailors, shoemakers and individual service people continue to do business in small shacks by the sides of roads. Most schools operate two to three shifts a day, and people may still wait hours for a bus. Government and banking personnel still work in temporary barracks, and there are relatively few theaters and restaurants.

But the people don't complain. Having immediately invested about one-third of the special reconstruction fund into industry, Skopje has built a rather solid base for economic development. The first stage of long-range planning was completed on schedule with the installation of main roadways, pipelines and sewer systems. The second stage, major residential construction, is under way. Most of the surrounding prefab settlements have already been incorporated into the city; luxury apartments are being bought along the "city wall"; hundreds of children attend new day-care centers and primary schools. A new hospital—Yugoslavia's largest—is due to open this year. Blueprints for a huge tubular transportation center are being finished in Tokyo.

Many Skopjans are quiet about the changes going

on around them. But the effects are increasingly obvious. The city has stretched from 3 to 15 miles in length in the last seven years. Near the center, high-rise apartment living is becoming the norm, and supermarkets are slowly replacing neighborhood stores. A few hundred yards from the old city limits, an elderly peasant still plows his corn patch with a horse, but his land is being consumed by Russian-designed apartment houses on one side and a six-lane highway on the other. The dominant feature on the northeast side of the Vardar is no longer the ancient wall of Kale Fortress, but a gleaming white, Corbusier-inspired contemporary art museum designed by Polish architects as a gift.

For those who remember Skopje when fruits and vegetables were growing 100 yards from the main square, the change has been disturbing. The traditional intimacy of neighborhood life is disappearing, and the streets are being taken over by cars. Old women wonder why they see so few of their friends these days. A middle-aged man, looking up at tall new buildings, says he feels like a stranger in his own city. A young secretary apologizes for store-bought pastry because there is no time to make homemade sweets.

Time has become more important because it takes longer to get places, and there is more to do. People leave their offices later than the usual 3 P.M. closing hours. Money, too, is becoming important. Profiting by easy, long-term credit after the earthquake, many people bought TV sets, refrigerators and cars and moved into new apartments. Today 87 percent of the city is paying off monthly interest charges.

Skopje is now many cities

Today's city is not one but many cities. The old Skopje meanders around the winding paths of the oriental marketplace and the curvings of the Vardar. The young city follows the blurred forms of motorists speeding over the crossroads of its past. And another city, yet unborn, will be found in the tracings of a new generation of architects.

Some people are afraid, some are doubtful, most feel it is still possible to keep the scale of human values in balance. But like the *corso* of young people which flows through the main square every evening, Skopje moves inexorably forward. New engineering techniques, new research institutes, new planning and building skills have produced a new level of professional competence. More people are reading, more people speak foreign languages, more people are anxious to travel and study abroad. Skopje is struggling against its own ignorance and isolation. The new physical environment is already exacting a new enlightenment as the doors of the city open onto the world.

Old and new Skopje come together at the edge of the city center. Earthquake-damaged homes will go; high-rise apartments take over.

The lady Crusoe of Australia's tropical islands

Alone on a coral strand—that's the life for Julie Booth, onetime skin-diving champion turned self-taught naturalist

"And lifting up mine eyes, I found myself
Alone, and in a land of sand and thorns."
Alfred Lord Tennyson

There she stands, windswept, her blond hair brittle from the water, her toes shriveled from the wetness, yet fashionably attired in shocking pink hot pants. She stands on a sandy beach—but one without umbrellas, beach balls or youngsters building sand castles. Rather, it is a minuscule coral reef off the Australian coast, and she is Julie Booth—naturalist, photographer, artist, fashion designer, champion skin diver and president and sole member of the women's lib chapter of Wreck Island. There she stands, alone.

Long divorced, this Sydney native visited Lord Howe Island to take part in television documentaries. That was her first taste of a coral reef and in her words, "I was hooked." Since then she has been living on a series of Australian islands—Lord Howe, Heron, One Tree, Fairfax, Hook and now Wreck. She tolerates periodic visits from the mainlanders who bring her water, mail and other essentials. Few others are successful in visiting her, although Malcolm Kirk, a freelance photographer and his wife spent several hours on the island last July. "In a way," Mr. Kirk says, "she is rather feminine, although she has been hardened by her life in solitude. She is quite aware of her femininity, and even saves fresh water for her hair." According to her brother, Dr. Norman Vincent of Weston, Connecticut, Julie had an illustrious visitor one day last fall when Canadian Prime Minister Pierre Elliott Trudeau joined her for some scuba diving.

Julie studies birds, reptiles, coral, storms—anything falling within her purview—with final evaluation of all her projects yet to come. The scrubby island that she currently calls home, half a mile by a quarter of a mile, is inhabited by white-breasted sea eagles, white and gray herons, rats (introduced by an Australian oil company) and green and brown turtles. There are three types of trees and plants—*Tournefortia, Pandanus, Casuarina* and *Pisonia*—and, of course, myriad clumps of coral.

Julie either dines alfresco in a grove near the two huts that represent home and office, or snatches a bite when hungry. The island is relatively flat; its highest point is about 20 feet above sea level. There are no flowers on the ground, but blossoms appear on trees from time to time. Rainfall is very, very light—except during cyclones. A kerosene lamp provides the only light, but it isn't important. Julie, who is up before dawn, retires early.

Dr. I. E. Wallen, director of the Smithsonian Institution's Office of Environmental Sciences, and Julie's chief correspondent, reports that with equipment from

Snapshot shows Julie when she first started island life. Today (opposite) she's on Wreck Island.

Julie's letters were selected and are introduced by Michael J. Bandler, frequent contributor to SMITHSONIAN. *Color photographs are by Malcolm Kirk of New York, one of Julie's few visitors.*

Julie Booth

the Smithsonian and funds from the Vetlesen Foundation, she has engaged in studies that have produced a number of discoveries from the investigation of mating habits of giant turtles to the effect of tropical cyclones on coral.

Throughout her stay on the reefs, the self-taught researcher has corresponded regularly with her sponsors on several continents. Letters written during the last five years, in particular, have followed her experiences on the Reef, from violent storms to thwarted advances by sex-starved turtles and goats. No one can tell it better than Julie herself, and so, herewith, follow letters from coral islands, written chiefly to Dr. Wallen and to Edwards Park of SMITHSONIAN:

January 17, 1966—Heron Island

. . . For the past eight months, I have been fighting my way through a mountain of red tape in an effort to obtain permission to spend one year on an uninhabited island, working on boobies and marine fauna. At last all my permits have arrived and my departure for Fairfax Island is on January 30, so I am excited.

Fairfax Island is a coral cay, about 40 miles southeast of Heron Island and is situated in the Bunker Group at the southern tip of the Great Barrier Reef. It is the only island for many hundreds of miles which has nesting boobies, and the only accessible place where one could stay for a prolonged period. Apart from studying the behavior of boobies and taking underwater shots, I have no definite project in mind.

March 29, 1966—Fairfax Island

. . . I have 1,000 brown booby bands here with me and have only banded about 100 juveniles and nestlings so far, for the simple reason that this species is extremely timid and easily disturbed. I cannot have the birds regurgitating or fracturing wings, in an attempt to flee whenever I walk through the island, so naturally I have to take it carefully.

Special permission was granted to enable me to live on Fairfax and to occupy the hut which belongs to the Royal Australian Navy, but for which they have little further use. I have to charter a boat at monthly (instead of fortnightly) intervals to bring supplies. Also all my fresh water has to be brought with supplies from the mainland.

I am currently poison-baiting the rats here which are so bad that they keep me disturbed from my sleep every night. I have been bitten three times. They are also eating eggs and fledglings of the boobies, baby turtles *(Chelonia mydas)* as soon as they hatch.

June 29, 1966

. . . Your telegrams came through gales from one fishing boat to another and were finally handed to me in a peanut-butter jar, scrawled on a piece of paper and barely legible.

. . . Have some good shots of the goats here and will forward these as soon as they are printed. My knowledge of domestic goats is nil, but I am rapidly learning about the behavior of feral goats. Was lying on the ground trying for some good angle shots when suddenly one of the goats jumped on me and tried to copulate with me. If you think that this is interesting, I might add that this particular goat was a mere three weeks old! Needless to say I took a good long look at myself in the mirror later.

Missed a wonderful opportunity to tape an extraordinary sound from a pied oyster catcher. There were four birds and one could feel the tension in the air around them. I decided to sit this out and witnessed a most spectacular display by one bird. . . .

Idea for a shark repellent

September 5, 1966

. . . Can you tell me if your Navy has a very effective shark repellent? To date, my chemical, extracted from a holothurian, made the eyes of fishes opaque and had small reef sharks running themselves aground when it was introduced into a pool at low tide. I am an extremely curious female and I just had to find out why one species of holothurian would remain in the open on a bare sandy bottom, whilst others buried in the sand or hid under coral, emerging only at night. In the process, I found that the exposed animal had something which the others lacked—namely, the ability to foam. This foaming substance tasted so bitter and also burnt my throat (I smell and taste everything) so I tried it as a tick repellent and found the ticks were not happy with this at all. I have not continued its use because I don't know whether it would have any harmful effects to my skin.

My idea is to buy a kid's plastic wading pool and catch small sharks. I could add a dye to my extract,

A broad stretch of coral reef surrounds tiny Heron Island, where Julie once lived.

Photographer Kirk conducts a taped interview with Julie at her "dining-room" table.

opaque the shark's eyes with some kind of covering and test the effects in the pool of varying concentrations. I have a quantity of MS222 to anesthetize the sharks if necessary.

The greatest and most effective test would be to apply the solution to baby turtles during the hatching season. I have never seen so many sharks at one time as there are during this period. They come in dozens at dusk and almost leap out of the water fighting each other to get at the hatchlings as they enter the water. I thought I would trick the sharks by collecting the hatchlings and releasing them in the lagoon, just as I returned from skin diving. I hadn't noticed any sharks there but, within seconds of releasing the turtles, sharks came from everywhere and I was obliged to leave the water to avoid snapping jaws!

October 28, 1966 (Letter to Julie Booth)

On behalf of the United States National Museum, Smithsonian Institution, I wish to acknowledge your gift of one Sea Snake, which is being accessioned into the U.S. National Collection of Reptiles and Amphibians in your name.

I have identified your specimen as *Hydrophis major*, and, as such, it represents the first and only specimen of this species in the U.S. National Collection. . . .

Sincerely, James A. Peters, Curator, Division of Reptiles and Amphibians

January 5, 1967

The seabirds warned me early this morning by their behavior that the weather would change and it would blow hard. I thought they must be wrong as it was a perfect day—until late afternoon. Black clouds sped across the sky, a few light showers until 8 P.M., then the elements went wild. It is now 9:45 P.M. and the hut is flooded out. Lightning has been flashing continuously every couple of seconds for more than two hours. The rain is heavier than I have known here, with occasional spots of large hail. At one stage I thought the front wall of the hut would blow in from the sudden strong gusts which have already felled trees. Sula, my dog, tried to hide under the bed but the floor is one vast swimming pool. The furious storm is lashing out at everything and the sea on the reef is roaring like an express train. Those gusts seem to be trying to pick up the hut and hurl it away.

January 7, 1967

. . . The weather is still bad and more booby chicks have died. It is quite heartbreaking to see parents standing guard over lifeless chicks or to witness the bewildered look of the changeover parent, who is always given a hearty greeting by his offspring. I did attempt to remove some of the corpses and was attacked by the parents who normally tolerate me fairly well. Have been up since four this morning bailing out my dinghy, still in my nightdress, in the pouring rain, up to my waist in the sea.

Later went for a walk through the island and found many more dead birds. Removed a dying chick which was inert, and put a dead one in its place to see what would happen. As soon as the parent returned, it looked all around, then began to attack the dead bird, thrusting it forward away from the nest site. The ailing chick made a complete recovery after careful nursing and was accepted when returned.

April 18, 1967

. . . I am down to my last few gallons of fresh water; canned food is adequate but monotonous. I feel I should make plans for leaving as the devastation has reduced the boobies to one-third of the population, but after seven cyclones I can live through anything!

Julie lived in this corrugated-iron hut until a cyclone blew it down. Another has been built for her.

Am hoping that present weather will not build into another cyclone as it will coincide with high tide and Fairfax Island will again be underwater!

September 4, 1967

. . . The experience of being frequently cut off here, at times low in food, and once with neither food nor water, has taught me a lot. I know it would not be possible for me to starve to death and am sure I'd manage on very little water. I may have to live on an inhabited island, so long as it's possible for me to be left undisturbed. Perhaps I sound antisocial. It's just that being alone I don't have to worry about finding food or water for anyone else. . . .

October 4, 1967

. . . For the last five days I've been painting numbers and measuring mating pairs of *Chelonia mydas*. By this means it is possible for me to follow the marked individuals underwater to observe their behavior, and I've come up with some very interesting aspects. This is all so exciting when one realizes that no measurements of mating males have been taken and very little known of courtship and mating behavior. I plunged in prepared to follow the turtles around the lagoon all day if necessary. . . .

October 19, 1967

. . . This island is crawling with cockroaches, but I prefer to tolerate such loathsome creatures rather than use pesticides which would kill my friends the spiders. I read somewhere that spiders were being fed LSD, and this resulted in odd-shaped webs being spun. Directly after the worst cyclone here, the spiders did exactly the same thing, and as far as I am aware, they were not under narcotic influence.

She is hard at work on a book about her life as a recluse and her scientific findings.

To return to the green turtles. I discovered one morning, when the wind and tide were in the right direction, that mating pairs were being washed ashore. This gave me the opportunity of painting numbers on their backs and measuring the carapace of at least the males. As soon as they went back into the sea after mating, I followed the marked females around for hours on end, which provided me with much useful information on mating and post-mating behavior. Unfortunately, the wind changed again next day, and I was forced to devise a new blend of paint which could be applied in the water. After much experimentation, I had licked this and again resumed behavior studies. The paint does not last for more than a few days in most cases so has to be renewed, but it has been worth all the trouble—even getting to look like a prune after so much immersion in seawater. One interesting fact is that females have a particular stretch of the lagoon which is purely for them. There they can lie on the sandy bottom and any males swimming overhead will not molest them. However, in any other area they are vulnerable. Also, the females have a special sign which is a definite "no" to ardent males. I tried the same signal on males who approached me with ardent eyes and intentions, and it worked! I had females thinking I was a suitor, and males hoping I was available! One has to learn to be pretty slick with turtles. . . .

May 1, 1968

. . . For the past year, I have been working daily on *Acanthaster planci* [see SMITHSONIAN, crown-of-thorns article, April 1970] behavior and constantly observing coral growth and regrowth (post cyclone) which has proved phenomenal. To prove my measurements are accurate, I have been going without food to buy film so that the same corals may be filmed at regular intervals. At present the Australian government is interested in my work here and has called for more information in order to provide more practical help.

Recording seabirds for deprived generations

Have lots of recordings of birds which will be coordinated to transparencies. This will cover almost every aspect of behavior of nesting seabirds at Fairfax, and at the rate of present human destruction of the Great Barrier Reef, I doubt that the next generation will ever hear a seabird call.

June 26, 1968

. . . Many people question my judgment in staying at Fairfax, but to my way of thinking one must have faith. If it is God's will that I live, I shall do so despite the conditions and risks; if not, there's nothing I can do about it.

Perhaps it's selfish of me to "tune out" to all the upheaval in the world—don't even know what our

Julie Booth

Prime Minister looks like, but I am aware of the rest of the world via radio. . . .
June 24, 1968

. . . Since the cyclones, there has been a remarkable, even phenomenal coral regrowth. I am not concerned with corals on the reef flat which anyone could study at low tide, but the fact that cyclones completely devastated whole areas here has provided me with a unique opportunity.

I am currently watching specific corals which in the pre-cyclone period were alive and healthy. After the cyclones these specific corals lay dead for months, then became covered with corallines or algae for months and then have begun to grow again. . . .
October 28, 1968—Hook Island

. . . Hook Island is right in the midst of the most popular group of Barrier Reef tourist islands. It is eight miles by four miles, and a mainland type of island with a vast bird and reptile population. The island is very rugged and living conditions are very primitive at present with six families and a floating population composed of various types of construction workers who are currently working on the underwater observatory. Despite the hair-raising experiences on Fairfax Island, I would dearly love to be back there.
June 9, 1969—Fairfax Island

. . . From January or February next year I will very likely have my son, who will be 18 then, with me. He hopes to spend a year with me since it will be the last on Fairfax Island as no further permits will be issued after December 1970. Carl has won two amateur photography contests without any help from me, and intends to make 16-mm movie and still films at Fairfax.
June 12, 1969

. . . You have no idea of the havoc on Fairfax in the few months that I was away. All of the nesting sea eagles, which I was studying, have been shot by fishermen in the last few months, and many of the other birds. What with mining activities on the Reef and predation by man, there will be little left for future biologists. The tendency to make stronger pesticides crops up in all of the country breakfast-session programs on radio. I often switch off when I hear of birds dying after attacking insects on crops. Aerial baiting of dingoes with poisoned meat makes me shudder. . . .
October 5, 1969

. . . From June till September there was a tick plague, and I spent half an hour up (and 15 minutes in bed) every night, all night, collecting hundreds of ticks off the walls, floor and my bed, averaging 200 adult ticks per night. As the boobies began laying, the ticks decreased inside the hut—no doubt there will be many birds dying as a result.
November 18, 1969 (from a tape)

. . . What are the things I miss out here? Firstly, my hairdryer, because I hate to have wet hair all night in the winter, and I do stay in the water so long that it is invariably wet all night. And secondly, browsing through bookshops, especially looking for paperbacks about animals and animal behavior.

I love to go down to the lagoon at dawn on calm days. On windy, rough days, there are lots of little stingers in the water which make life uncomfortable. But I go down every morning whenever possible and take a plunge, have a bath in the lagoon. Alongside of me are reef herons and pied oyster catchers, little pied cormorants and sooty oyster catchers with a great big red ring around their eyes and a red bill, lots of shore birds, silver gulls, all lined up, and they're all taking a bath too.

"I couldn't live without perfume"

I love to do a man's work if I am physically capable, but I could shed tears from sheer frustration trying to do some of the tasks that are required living alone. I like to make all my furniture. I have made all my furniture for the hut out of driftwood. But at the same time, if I had a dollar to my name and was hungry, I would spend it on a bottle of perfume rather than a meal, because I could live without a meal but I couldn't live without perfume. I like to smell sweet and clean. . . .
December 8, 1969

. . . The Lands Minister has now decided to give me a ten-year lease on the whole area of Wreck Island instead of a small part. [Julie has been living there since early 1970.] My idea is to have two separate huts, one for sleeping and paper work and the other for kitchen and lab so any visitors can use it also. Of course, by visitors I mean your staff and Australian Museum staff. I have the right to keep anyone else off.

Julie now has her 19-year-old son at Wreck Island.
He hopes for a career in wildlife photography.

A 1,400-foot-long string of weather balloons took France's Audouin Dollfus and his telescope to a height of 52,000 feet in 1959.

By Kurt R. Stehling

Balloon astronomy, a case for more

'Poopybags' fraught with hazards, say critics. Versatile, safe and inexpensive vehicles for astronomical observation, says the author

Most of us are, or ought to be, grateful for the protective envelope of atmosphere around the Earth. But there are some literally benighted individuals who consider the atmosphere not a blessing but a bore and a nuisance. These individuals are astronomers.

For astronomers, paradise is a sterile desert with *no* atmosphere, a place like the Moon. Now, for the most part, astronomers must peer at the universe through hundreds of miles of gases, dust and water vapor which heavily absorb, distort and obscure all the cosmic happenings for which they search.

The twinkling of a star (called scintillation) implies nothing romantic for the scientific observer. It means an image blurred by winds, air currents and turbulence. And the larger the telescope or the greater the magnification, the more jittery the image becomes.

A much more serious problem than scintillation is the selective absorption by the atmosphere of much—if not most—of the radiation from outer space.

Most of the light from the far (visible) violet region to the dark red and near infrared portions of the spectrum *does* get through, and the air is fairly transparent to radio waves beyond 1 mm in wavelength. But the atmosphere is totally opaque to ultraviolet, x-ray, gamma-ray and most infrared radiation—except for a few windows in the infrared region.

A science advisor to the federal government and a licensed gas balloonist, the author has worked on many rocket and high-altitude science projects.

Alas, the atmospheric scattering of light which gives us beautiful blue daytime skies makes it necessary to observe at night. Of course, daytime observation *is* possible from an airless surface, such as the Moon where the sky is always black.

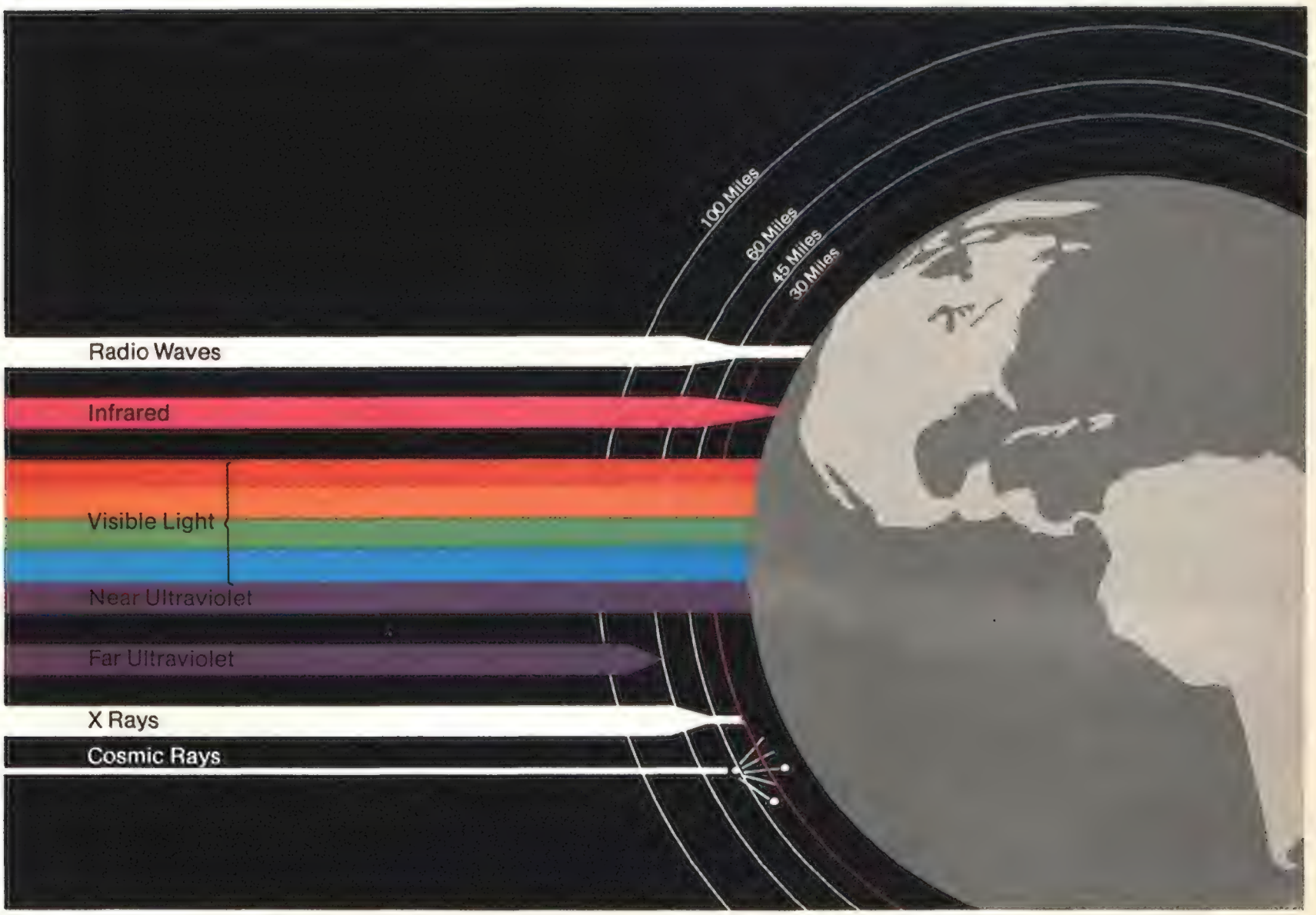
So—what to do? The classical approach has been to put the telescope on a mountaintop. Thirty percent of the astronomically important atmosphere exists below 8,000 feet. Above 8,000 feet, the air still absorbs almost all of the nonvisible spectrum but at least the air is steadier and local city lights, many clouds, and fog are left below. Most of the world's biggest observatories are on hills and mountains. Why not build on even higher mountains?

Except for small-scale experiments (and a few existing major installations), astronomers do not plan on using mountains higher than 11,000 feet. The problems of construction, access, logistics and breathing become (if you will pardon the expression) astronomical above that level, and the gain in seeing is trivial.

So, knowing theoretically that much interesting radiation from stars and nebulae must be emitted and absorbed by the atmosphere, astronomers have, for at least 50 years, pondered ways of moving their equipment to altitudes above 40,000 feet where truly significant payoffs in increased infrared intensity and in reduced turbulence could be gained.

Early in the century, instruments called bolometers or radiometers, were placed at the focal points of astronomical telescopes and received recognizable solar signals. This proved to astronomers that the sun (and presumably other heavenly bodies) must be emitting infrared light. They soon realized, however, that only a small fraction of the theoretically predicted radiation was able to penetrate the atmosphere.

Also, by around 1910, physicists had noted that sensitive, newly invented radioactivity detectors sensed not only the emission of radioactive materials such as uranium and radium, but also radiation that seemed to emanate from nowhere in particular even when no radium or other radioactive matter was present. At first the ground was suspected, but later the instru-



Earth's atmosphere is selective about what radiation (and how much) it absorbs. Maximum altitude for balloons (in red) is high enough to detect much of the infrared and some cosmic rays, radio waves and x rays. For clearer observations of the universe, satellites must travel beyond 100 miles.

ments showed *increased* activity when carried in balloons—and the increase was a function of altitude. This indicated a cosmic origin for the radiation which later was proven to consist of particles—*i.e. atomic* nuclei—that we call cosmic rays.

So, more and more, astronomers turned to the only practical flying machine around—the balloon. Though used now, airplanes were then limited to low altitudes and vibrated excessively. Several balloon missions brought back useful data and, importantly, played a role in perfecting the kinds of equipment needed for high-altitude observation.

After World War II, in the 1950s and 1960s, however, rocketry and then satellites became available to astronomers and balloon astronomy has had to take a seat well to the rear. Captured German V-2 rockets were brought to the United States, refurbished and reworked for high-altitude research use. A V-2 flight beyond the atmosphere obtained the first ultraviolet spectrum of the sun, while smaller U.S. developed WAC-Corporal and Aerobee rocket flights resulted in such important achievements as the first detection of galactic x-ray sources in 1962 and the first precise positioning of an x-ray source in 1964.

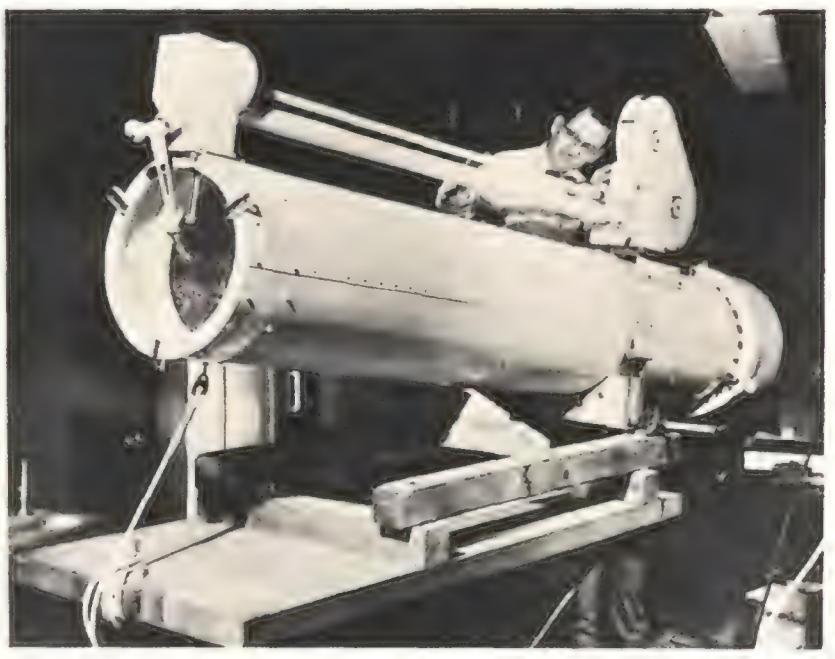
Recently the National Aeronautics and Space Administration (NASA) has tried to launch three Orbiting Astronomical Observatories at a cost of about $300 million. Though one has given us our first good look at the ultraviolet region, the first failed and the third never made it into orbit—at a cost of about $200 million. So it may be appropriate, in view of the vast expense involved, to look again at the more modest but less expensive potentialities of the balloon.

In 1931, Auguste Piccard, the Swiss physicist and aeronaut, dramatically improved high-altitude balloon techniques with his ascent to over 50,000 feet. For this flight he developed a closed, spherical aluminum cabin—the forerunners of today's manned spacecraft. On board were photographic plates and geiger counters with which he studied cosmic-ray particles. He discovered several new species of nuclei and he found new data on atmospheric radioactivity.

There were other scientific balloon ascents in that decade, but it was not until after World War II that the development of plastic films like polyethylene and mylar reduced balloon weights and costs by a factor of ten, improved gas retention, and provided astronomers with an inexpensive research vehicle. Meanwhile astrophysical instrumentation was improving. Infrared detectors, x-ray sensors, photographic emulsions and electronics yielded versatile systems which could be commanded from the ground.

In 1954, Audouin Dollfus of the Meudon Observatory in France, flew a net-covered balloon to 23,000 feet for a nighttime flight. In his open cabin he carried a specially designed telescope equipped with an infrared spectrophotometer. This was the first balloon flight, manned or unmanned, that was instrumented for a purely astronomical purpose. He observed Mars, the Moon and the sun, concluding that higher altitudes were necessary to achieve really significant infrared measurements, but he succeeded in proving that a balloon-borne cabin had enough stability for the operation of a telescope. On this trip, and in a later flight in 1957 to about 18,000 feet, Dollfus photographed the hitherto inadequately observed "rice grain" effect of granular structure of the solar surface. This granular structure, rarely seen from earth, reveals the unstable solar surface.

Two years later, in 1959, Dollfus ascended in an enclosed cabin lifted by an entirely different kind of



Stratoscope's 12-inch telescope, with perforated tube for cooling, returned detailed pictures of the surface of the sun (see facing page) in 1957.

balloon system—a 1,400-foot-long string of rubber meteorological balloons which, unlike the regular balloons whose bottom or "appendix" is open, were sealed. They expand with altitude and burst when the skin is stretched too much. Dollfus, with this hair-raising system, managed to reach 52,000 feet, and spent about five hours making observations. He refined the technique for detecting water vapor in the Venusian atmosphere. Later, in Switzerland, Dollfus detected water vapor for the first time on Mars.

Manned v. unmanned flights

By the late 1950s, the experimenters were faced with a choice between manned and unmanned balloon flights. If they wished to use complicated observing equipment requiring constant attention, and if the prime tool of the astronomer—the camera—were to be used, then the case for a *manned* observatory cabin was strong. More simple equipment with only one or two functions to perform could be sent aloft *unmanned* with radio signals pointing the equipment, controlling the flight and recording the data.

Supporters of manned flights, among them Dollfus in Europe and such U.S. astronomers as J. Allen Hynek of Northwestern University, argued that the complications and greater costs of manned systems were outweighed by the increase in flexibility of operation, interpretation and maintenance which accrued from the presence of a live observer on board.

On the other hand, protagonists of unmanned flights argued that safety, cost, and the increased weight and jitter introduced by an observer and the equipment to house him militated against manned cabins. It would be cheaper and more convenient in the long run, they reasoned, to launch a variety of "simple" unmanned observatories.

Meanwhile, the Office of Naval Research was supporting a series of manned "Stratolab" flights carrying closed cabins. These were mostly systems tests (though they had equipment aboard for measuring cosmic rays). In 1959, on an experiment suggested by John Strong, then a physics professor at Johns Hopkins University, a Stratolab mission searched for water vapor in the atmosphere of Venus. Though the data were somewhat ambiguous, Professor Strong concluded the Venusian atmosphere contained water vapor. The Stratolab flight had established that the telescope system could be reasonably steady and independent of cabin movement.

Not to be outdone, the Air Force took a stab (unfortunate expression, perhaps) at manned balloon flights by supporting Project Star Gazer in 1961-62, but problems with the balloon system discouraged the Air Force whose jet jockeys were not, in the first place, overly enthusiastic about the "poopybags." The Air Force discontinued manned balloon ventures.

Concurrent with the manned efforts, an unmanned project, Stratoscope, achieved a series of resounding successes. Inspired by Martin Schwarzschild, an astronomer at Princeton University, and funded by the Office of Naval Research, Stratoscope I was launched in 1957 and was quickly followed by several more flights. Results included a series of very detailed pictures of solar surface granulations. By 1963, a double-balloon system in the Stratoscope program had taken a 7,000-pound payload to about 80,000 feet. On the second flight that year new infrared spectra of the Moon, Jupiter, and seven stars were obtained. Significantly, the telescope system on this flight was recovered intact. The program has continued: A Stratoscope II flight in 1970 lifted a radio-controlled 36-inch telescope to 80,000 feet and brought back extremely high-resolution photographs of Jupiter, Uranus and the nucleus of a distant galaxy.

There have been many other unmanned flights. In 1964, a group from Massachusetts Institute of Technology flew a balloon to 130,000 feet and discovered

Stratoscope photograph of the solar surface. The light spots are rising columns of incandescent gas; in dark areas, gas sinks.

"hard" x-ray radiation from the region of the Crab Nebula. It had been high-altitude rocket measurements in 1962 that had first detected galactic x-ray sources, but this balloon test showed that a balloon could reach the altitude necessary to make a contribution to the exciting new field of x-ray astronomy: Below 120,000 feet x rays are largely absorbed.

Most recently, in October 1970, Walter H. G. Lewin of M.I.T. discovered an unusual x-ray source in a distant constellation. The rapid fluctuation of tremendous x-ray energy from this source was astounding and, while Dr. Lewin has not speculated on the nature of the event that generates such energy in so erratic a pattern, he suggests that if such objects are widespread, they may be an entirely new class of astronomical objects, as were the quasars and pulsars. Dr. Lewin discovered this object with x-ray detecting equipment borne aloft in a balloon 550 feet in diameter that ascended to 150,000 feet over Australia.

The controversy between manned and unmanned flights, however, has never been really settled. Manned flights simply petered out, not so much because of technical limitations or of cost problems, but because of rapid improvements in the electronic instrumentation required for unmanned flights.

NASA, which gave some support to ballooning efforts in the Fifties and Sixties was, of course, primarily interested in experiments borne aloft in spacecraft. Furthermore, several near accidents with manned balloons caused apprehension at NASA.

A brief for balloons

To be sure, the launch is the most difficult and often heartbreaking part of any balloon flight. Launch windows—when the weather is clear and the winds at the surface and aloft are low—have been a problem. But great strides in launch efficiency and other balloon techniques have been made in the past few years, especially at the balloon flight center of the National Center for Atmospheric Research in Palestine, Texas. Shipboard launches in the Caribbean have worked very well. A ship can sail *with* the wind and *away* from bad weather. The small flat deck of a 100-foot cutter would make an ample launching platform.

An important economy in balloon astronomy is the recovery of the payload. Equipment and even manned cabins can be soft-landed, using parachutes and, for recovery at sea, flotation gear. The balloon could also be brought down and reused, but special techniques (which appear feasible) will have to be developed. Research would be needed to create balloon systems that could be maintained for 20 to 40 hours, over 120,000 feet. It is already feasible to lift two tons to that altitude, using a 30-million cubic-foot bag. To lift four tons, a 70-million cubic-foot balloon—or cluster of balloons—would have to be developed. Also liquid helium for gas replenishment might be required.

It is, in my opinion, worth investing the time and money to seek and develop these improved techniques. Balloonists have proved that these floating observatories can yield valuable astronomical data. Unmanned experiments have been conducted at altitudes approaching 160,000 feet which is roughly the maximum ceiling for balloons. I am confident that manned flights, using closed capsules, could do the same. At that altitude, a large part of the x-ray and gamma-ray radiation, and most of the infrared, is open for inspection. New plastic films or reinforced fabrics of great strength, improved methods of balloon handling and inflation, advanced data telemetry links and power supplies—all these now exist and can greatly extend the scope and sophistication of balloon operations.

Balloon astronomy cannot replace space astronomy: A spacecraft can escape the atmosphere altogether and yield thousands of hours of observing time each year. Space techniques are essential for ultraviolet astronomy and extremely valuable data has been yielded by

Electrical difficulties prevented Star Gazer telescope, shown above with launch apparatus, from operating. Unmanned systems took up the work.

the orbiting observatory programs. Yet, even with its altitude limited to the upper reaches of the atmosphere, balloons can dramatically extend the frontiers of astronomy, in visible imaging, infrared gamma-ray and x-ray work—and at relatively low cost.

A manned flight, carrying two large telescopes, a variety of spectrometers, equipment for detecting microwaves, x-rays, gamma rays, and infrared—and the astronomer's prime tool, a camera—could be organized for little over four million dollars. With proper recovery techniques and reuse, ten additional flights would cost a half-million dollars each. Such a program, with over 400 hours of at least six modes of observation at a cost of under ten million dollars, compares very favorably with the extremely high costs of obtaining such data by satellite.

In a recent assessment of scientific priorities for the next decade of space research, the Space Science Board of the National Academy of Sciences recommended that NASA double its support of balloon astronomy. The suggestion has been ignored for the time being, but it seems that the time has come to take that old-fashioned craft, the balloon, more seriously.

Since its first launch in 1957 to its most recent in 1970 (right), Stratoscope has yielded much valuable astronomical data.

By Shep Abbott and Tex Fuller

A fresh look at the cheetah's private life

An intimate glimpse at the deft style of cheetahs, by two young men who went to the Serengeti Plains to live with them

The cheetah runs down its prey in broad daylight at 70 miles an hour. We knew this, and little more, about the animal when we disembarked at Nairobi Airport loaded down with camera equipment and one change of clothes apiece. A common boyhood fascination with the cheetah had taken us this far.

In Nairobi we learned that the right place to film cheetahs was the Serengeti National Park in the Seronera region where the woodlands come down to meet the plains. There, through the inspiration of Dr. John Owen, director of National Parks in Tanzania, the Serengeti Research Institute had been founded and an international group of scientists was studying the Serengeti ecosystem. After several weeks, Dr. Owen said the Institute needed us part-time on an aerial photography survey.

We began work on the 8th of June 1970, just as the rains were ending. Here we were, finally, at the precise center of our universe. All that remained now was to find cheetahs.

A Masai park guide named Samuel told us how to find them: "You must go out to the plains before the sunrise and drive in circles all day." He said to let the herds of Thomson's gazelles find cheetahs for us. If a Tommy herd spotted a cheetah, it would boil with excitement, little black-and-white tails going like pinwheels, legs stomping and the entire herd moving *toward* the cheetah with some complex survival mechanism at work. The male Tommys would be out front with the females and young behind. All would be barking, like so many fat men blowing their noses.

If you saw this, Samuel told us, the cheetah's hunt would be over; it would be sitting away from the herd looking smugly innocent. Actually, in raising such a commotion, the gazelles do the cheetah a favor, making their discovery of the cat so obvious that it does not attempt an exhausting and unproductive run.

We used Samuel's technique for two weeks. We learned the terrain and how to count the hours in f-stops and shutter speeds. But we saw no cheetahs.

Finally one evening as we were racing back to the Institute trailing a great billow of dust we found Brigitta. We were thinking only of showers and food when, in the last flare of purple dusk, she strolled across the road 40 yards ahead. We jammed on the brakes, the dust poured in on us, and she continued

Amateurs, the authors simply took off last summer for Africa, spent four months in the bush, and returned with what zoologist John Eisenberg calls "a unique look at cheetahs through undistorted lenses."

across, paying us no notice. Was this the way it was to be? You find cheetahs by not thinking about them?

Thrashing her tail like a great whip, she walked on. We followed at idle speed. A full moon rose. No clouds. We would spend the night unfed and dirty; we were urchins in the promised land.

Brigitta lay down in the middle of the plain and we pulled up alongside. She napped like Nefertiti, chin on shoulder, elegant legs draped across the bare ground. To our knowledge, no one had ever spent a night in the wild with a cheetah. Our notes read:

8:10 Brigitta rests. We are surrounded by the calls of lion, leopard and hyena.

8:20 She rests no more. Head up, looking toward us.

8:24 She's up. Heads diagonally toward river. Walking cautiously. Runs a bit. We follow.

8:30 She moves 30 yds. away from us and we can barely make her out thru binoculars. She stands like a pointer now with the right foreleg up.

8:32 She's moving again. Can't see her. We go in her direction and find her lying down facing us.

10:38 All of us have been sleeping. Brigitta woke us up by leaping up on the hood of the Land-Rover. She is there now and alternates between peering in thru the windscreen and watching the landscape. She scared the hell out of us.

12:13 We have been playing cat and mouse. Brigitta jumps off the hood, races around the car and then in the direction the car is headed. We follow and find her sitting, looking away. We stop, she comes over and up on the hood again.

This game continued most of the night. At dawn, Brigitta began hunting, using the hood as a vantage point for spotting prey. She would jump down and begin trotting after a herd, break off after a low-speed probe and come back to the hood.

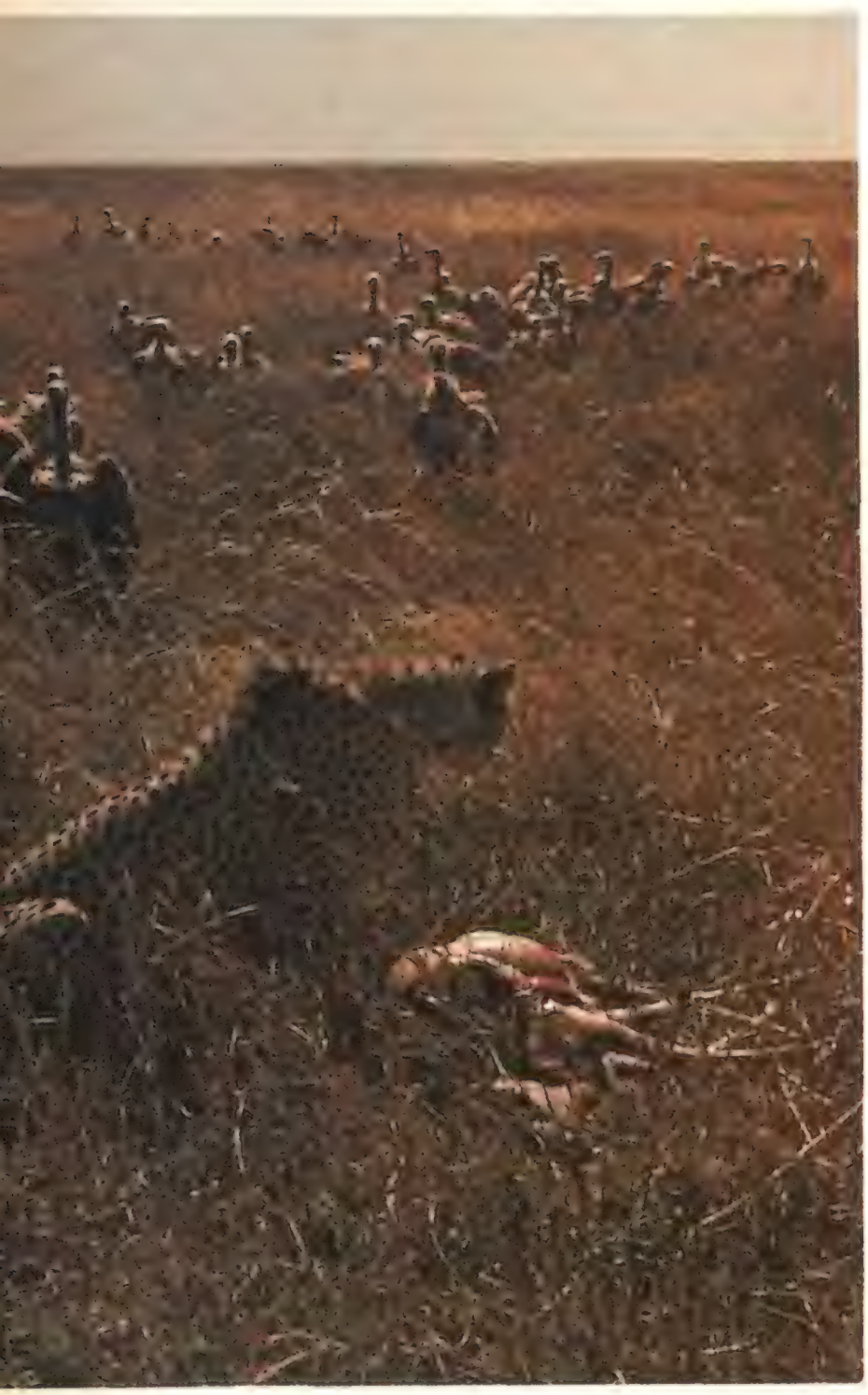
The Thomson's gazelles were in the midst of a breeding peak and there were young all over the place. After several probes Brigitta killed one.

Brigitta's hunting method depended to a great extent on the type of prey. Going after a baby, or a female herd, she employed little, if any, stalk. Instead,

Loping at half speed, a cheetah probes a herd of Thomson's gazelles. See following two pages.

In panic, a female darts out and spectacularly vaults her pursuer. It proved a fatal turn.

Not an overpowering leap for the throat,
but a deft gesture brings down the exhausted prey.



The vultures quickly assemble, only the first
scavengers to contest the cheetah's kill.

she would begin loping toward the herd at about 30 miles per hour. The herd would scatter. The cheetah's sudden move would break the bond between mother and baby, leaving the young gazelle in a state of confusion. The cheetah used the same technique on adult female herds to force one gazelle to make a fatal turn or to probe the herd for the sick or crippled. In any case, once she had singled out a victim, the outcome was virtually assured. She would turn on the speed and close in, overpowering her victim whose weight might be only one-seventh of her own.

Later we observed Brigitta hunting adult male Tommys. A long, tense stalk was required and the male gazelle—a big animal which the cheetah cannot simply overpower—seems virtually an equal in the contest. The male Tommy establishes a territory, usually on open plains: Often the cheetah never gets within striking distance before the Tommy is away. Instead, the cheetah must look forward to a long chase, going full out, step for step with the gazelle. The object seems not to catch up with the prey but simply to run it into the ground—to exhaust it.

The kill: quick, silent, clean

On one occasion, we observed a chase that lasted 30 seconds at full speed. Twice Brigitta seemed to be in a clear position to bring the Tommy male down. Once, it simply stopped to change direction and Brigitta, only a few yards behind, leapt over it rather than attempting to knock it down. Ten seconds later, the Tommy stumbled and fell but obviously had a good deal of strength left; Brigitta stood by and waited for him to regain his feet and begin running again. Finally the gazelle began to slow and stumble with Brigitta right behind. At last, Brigitta's forepaw shot out, knocking the Tommy's hind legs out from under him, and he fell exhausted and unmoving. To have lunged at the throat before the Tommy was fully exhausted would have risked goring by the horns of the thrashing victim. After the kill, it took Brigitta over an hour to regain enough breath to begin eating.

Now, on our first day with Brigitta, she was sitting upright, throttling the young gazelle, its legs barely touching the ground. Exhausted, she sat for several minutes in the same position. Her tail whipped and thrashed and her forelegs occasionally snapped spasmodically. Eventually she dropped the gazelle but continued to sit jerking her head around apprehensively. Her breathing rate at this time was in excess of 200 inhalations per minute.

Suddenly she snatched the infant up and, holding it by the underneck, carried it dangling between her forelegs to the shade of the nearest tree. She sat for 20 minutes regaining her breath before she began to feed.

In the thin light of dawn, two males would play before setting off together to hunt.

At a rumble with hyenas, one male flees. His partner has already fled to a safe tree.

During the night we had been surrounded by the sounds of other predators—lion, leopard, hyena. The cheetah is the only predator that does not roar extensively and now, having watched the kill and observed Brigitta's apprehension afterwards, we began to realize why this was so. The vocalizations of other predators are, in part, a function of their territorial nature, but the cheetah does not want to call attention to itself. In fact, its ecological niche appears to include the territories of other predators, the majority of which can run the cheetah off its kill. So, while the others depend on making their presence known, the cheetah depends on keeping its presence unknown, and its hunting technique seems to have evolved to this end: quick, silent and clean.

As she sat over her kill, there was good reason for Brigitta's apprehension. Vultures arrived, lighting in the tree above her or in groups on the ground. As the big birds whistled in, Brigitta alternated between eating and sitting up. The vultures made no direct attempt themselves to scare her off, but those on the ground, perhaps 70 in all, gradually tightened their circle around her to within seven yards. While feeding, Brigitta's attention was suddenly riveted to a spot at our backs. A lioness was approaching. Brigitta's meal was over: She moved away directly but without panic, the vultures burst upon the carcass, and the lioness ran in and quickly dispersed them.

Due partly to its physical structure which includes nonretractile claws and a delicate bone structure, the cheetah does not defend its kill. This makes it a prime scavenging target. We realized that during the dry season, the cheetah does a good deal of the meat-procuring for the other carnivores in the region. The cheetah is the most adept predator of gazelle (the leopard, also adept, hides its kill from scavengers in a tree), and gazelle is the chief prey in the area during the dry season. A number of lions in the area starve to death each dry season, and we wondered how many more might starve were it not for cheetahs.

During the several weeks we worked filming Brigitta, she spent a good deal of time on the hood of the Land-Rover. She used it as an observation post but also enjoyed sleeping there, which amused us greatly and created a strong bond between us. Several times she urinated while on the hood and, of course, we were greatly honored.

From time to time we had seen two nearly full-grown males working together in the area and eventually we switched our attention to them. They were readily identifiable by hairline scars they bore on the bridges of their noses—we called them the scar twins: Long Scar and Short Scar.

They were the only full-grown cheetahs we saw together at Seronera. In other areas such as Nairobi National Park, large units of adults are often seen, but there the usual prey is a good deal larger than the gazelle, and the competing predators are fewer. Here, companionship was of little advantage; indeed, it seemed downright inefficient. The scar twins would both run at the same victim and both would share the kill, but there was no observable cooperation.

In a nest deep in the dense grass near the river,
a mother lies with four star-crossed cubs.

On one occasion, for example, Short Scar stalked to within ten yards of a male gazelle. Just at the instant when we felt he would make his dash, Long Scar leapt into a tree 30 yards off, and the Tommy was away. Short Scar sat up, stared at his brother until he came down from the tree and then walked heavily away. The twins' normal hunting style was simply to lie in wait for a Tommy to walk into them—a practical solution to their problem of inefficient cooperation.

Nor did their companionship make them less vulnerable to harassment by other predators in the area. In fact, they seemed inept at avoiding confrontations with hyenas. Once after Short Scar connected with a female gazelle, it emitted a goatlike bleat—the only time we heard such a cry. Within seconds two hyenas raced up, chased the twins off the kill and ran off with it. The twins made no attempt at defense.

We saw cheetahs chasing jackals on three occasions but never when feeding on a kill. Jackals have a habit of following and pestering the cheetah and during these times the chases took place. Once the twins stalked and chased a jackal which was barking nearby. Though they appeared to be in a good position to catch him several times, they broke off the chase after about 30 seconds, and the jackal stood by barking. This attracted a hyena and as he lumbered in, nose to the ground, the jackal ran over and bit him on the leg. The hyena took out his annoyance not on the jackal but on the twins, and while he moved in on them three more hyenas arrived. The twins held their ground, hissing and spitting with bared teeth. The hyenas closed in slowly. Three of them formed a phalanx and, shoulder to shoulder, moved on Long Scar. As they broke into a run, he leapt up a tree and Short Scar ran 50 yards into the tall grass and sat peering back. After snorting around the base of Long Scar's tree for some minutes, the hyenas left. Fifteen minutes later Short Scar coaxed his brother out of the tree. The two of them left the area that day, and we never saw them again.

The next day we found Evelyn. As we approached the top of a rise, we spotted her walking slowly through the grass, about a half mile from the scene of the scar twins' rumble. No sooner had we seen her than she broke into a run and quickly killed a female Tommy. She was very tame, and she let us drive up and watch her eat. She ate hurriedly and, after what seemed pointless meandering and some long stretches where she sat cleaning herself, she led us into the high grass and thornbushes that bordered the river. She snaked through the grass with great care. Then she was gone.

We drove up to the thornbush she had disappeared behind and there, nestled under the branches in the dark shade, was Evelyn and four new cubs. We watched speechless for several minutes. If we had been 20 seconds later coming over that rise, we never would have found Evelyn—now we were part of the family.

The cubs' eyes were just opening, their fur still sticky. We estimated their age at about a week. They had the silver-gray streak of long hair down the back which cheetah cubs retain for perhaps three months, probably nest camouflage. Wobbly on their feet, the cubs greeted their mother like baby chicks, with a symphony of whistles and chirps, and the mother busied herself washing the cubs, paying special attention to the ano-genital area, perhaps to reduce nest odor and/or to stimulate defecation and urination.

We spent 12 hours a day during the next three weeks at the nest. Though the cubs did a good deal of exploring, Evelyn's belly was their focal point, and they would sleep, piled up against her, much of the time. She left to hunt in the morning about once every two days, often returning late in the day. When she left, the cubs would scramble back into the darkest, most secluded corner of the nest, curl up together and sleep.

Death stalks a family

During the days that Evelyn did not hunt, she would leave the nest for exercise and reconnaissance, and to drink. We saw her drink three times in six days—a very high frequency compared to the other cheetahs we observed—probably a need associated with her motherhood. She always remained in the immediate vicinity. Even her hunting area was restricted, and occasionally we could watch her hunt while we sat with the cubs at the nest.

Evelyn evidently had no objection to our presence; she would come and go, paying little notice. But she did move the nest—eight times in all while we were with her. These moves were only over short distances and she carried the cubs one at a time by the scruff of the neck. After moving all four cubs, she would return to the old nest, apparently looking for another cub: It seemed she couldn't count.

On the morning of our fifth day at the nest, one cub was missing. The nest was in no way disturbed, and Evelyn was acting normally. Though all the cubs had appeared to be in good condition, we assumed the missing one had died of some illness.

The second cub was lost two days later. While Evelyn was moving the cub to a new nest, two lionesses jumped out of the bush at her. She dropped the cub and fled, and one of the lionesses killed it. Evelyn returned to the nest deeply disturbed. We noted:

4:37 Evelyn up listening. Leaves nest, climbs broken tree, looks around, lies down in tree.

4:47 Jumps down quickly, heads for dry river bed, flushes two unseen reedbuck but ignores. Climbs up on grassed-over termite mound. Watches.

5:27 Walks quickly back to nest but lies down outside with head up. Lionesses still in sight.

6:32 Evelyn has not moved. We leave.

Next day:

7:36 Arrived to find cubs nursing. Evelyn now stands, looks around, stretches, slowly leaves but hurries back after 30 sec.

7:51 Evelyn walks 15 yds. but returns in one minute with greeting.

7:53 Walks to road, rolls, scratches ear. Suddenly jumps up and runs toward where cub was killed and lionesses slept yesterday.

8:00 Sits near lioness' spot looking back toward den often. Begins a high-pitched call.

8:07 Moved closer to her water hole and now calls again 12 times at two-second intervals. Jumps up and runs back to nest.

8:15 Walks out, around nest and back in.

It is important to note that the mother's first instinct when she feels the cubs are threatened is to flee rather than to defend them. One morning as we sat with the family, a small branch from a tree fell very close. Evelyn leapt from the nest, over the hood of our car and ran perhaps 30 yards away, leaving the cubs completely vulnerable. She watched from that distance for five minutes before stealing her way cautiously back to the nest. We can only assume that quick flight from the nest at the first threat of danger is of greater value than to remain. The cheetah being delicate, solitary and dependent upon perfect physical condition for survival, is a bad bet to defend her nest against intruders. On the other hand, if she moves away with lightning speed, perhaps the intruder's attention will be diverted from the nest to her.

For two more days after the loss of her second cub, Evelyn's erratic behavior continued, gradually diminishing. It was three days altogether before she moved the nest, and then she moved it four times in three days.

The last of these moves took them to the base of a grassed-over termite mound in a dry riverbed. Here, on the day following the move, we returned to find only one cub and Evelyn very distressed. For most of the day she sat on the mound calling—a very high-pitched chirp that cut the air on a descending scale. In the evening, she moved the one cub to the top of the mound and continued her mournful call as night fell.

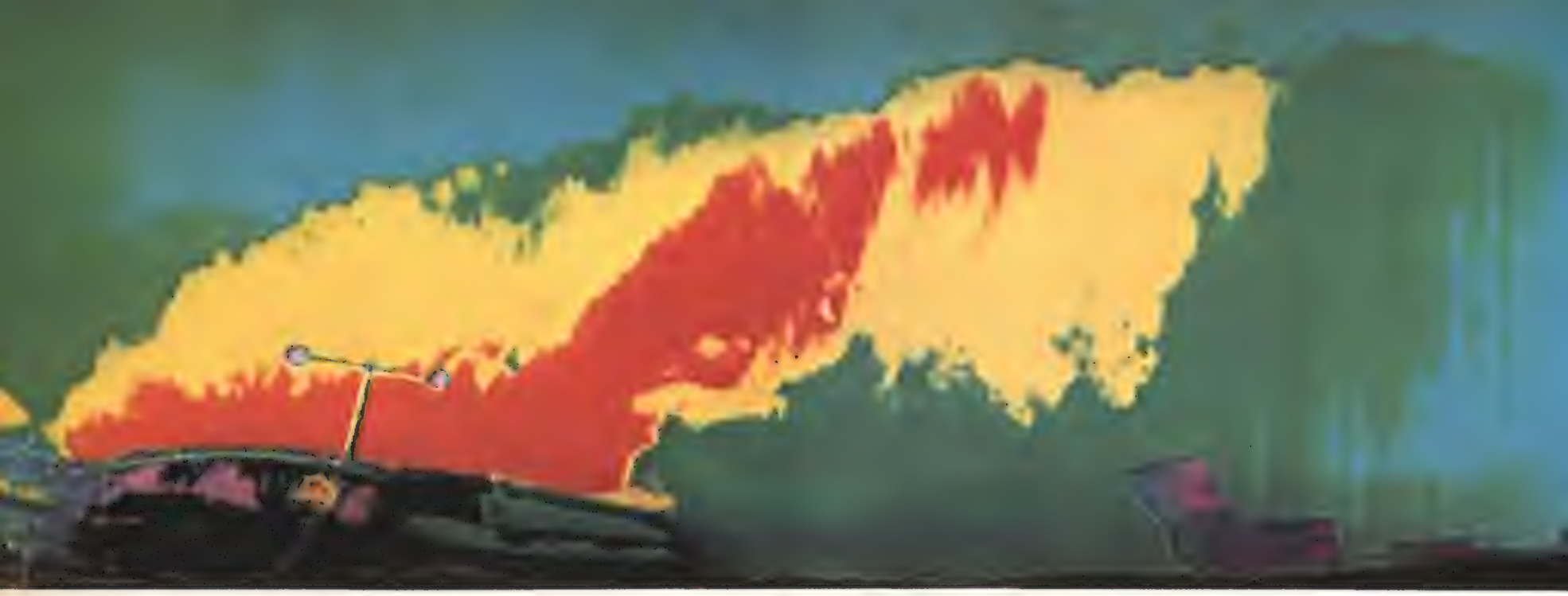
The next morning Evelyn was gone. The cub was on the top of the termite mound, chirping from time to time. We stayed for three days but Evelyn never returned. It is natural for cats, when reduced to a litter of one, to abandon it, due mostly to the lack of stimulation and the drying up of the milk source.

On the third day of Evelyn's absence, Dr. Owen sent permission for us to collect the cub. We raced out to the nest, and the cub stirred feebly on top of the mound. It seemed the most profoundly helpless creature in existence. We lifted it, hissing and spitting, out of its world.

To our surprise, the cub calmed down as we carried it to the car and what astonishment it may have felt soon gave way to active inquisitiveness. At the Institute, a formula was ready and the cub was home. Our work was complete in late September and, when we left the Institute, the cub had grown strong and active and had complete freedom of movement. And that, for cheetahs among others, is a good thing.

While authors Fuller (left) and Abbott watch her, the cheetah watches for game from their Land-Rover.

With three cubs gone, the mother called mournfully into the night. The next day she disappeared.



With the gaudiness of tropical birds, new infrared process shows hot water from power plants in Lake Michigan (right) and a New York river (above).

By Jane Stein

A hot debate, generated by hot water

Pressed by environmental activists and government, the power industry seeks to cool the water it uses to cool its plants

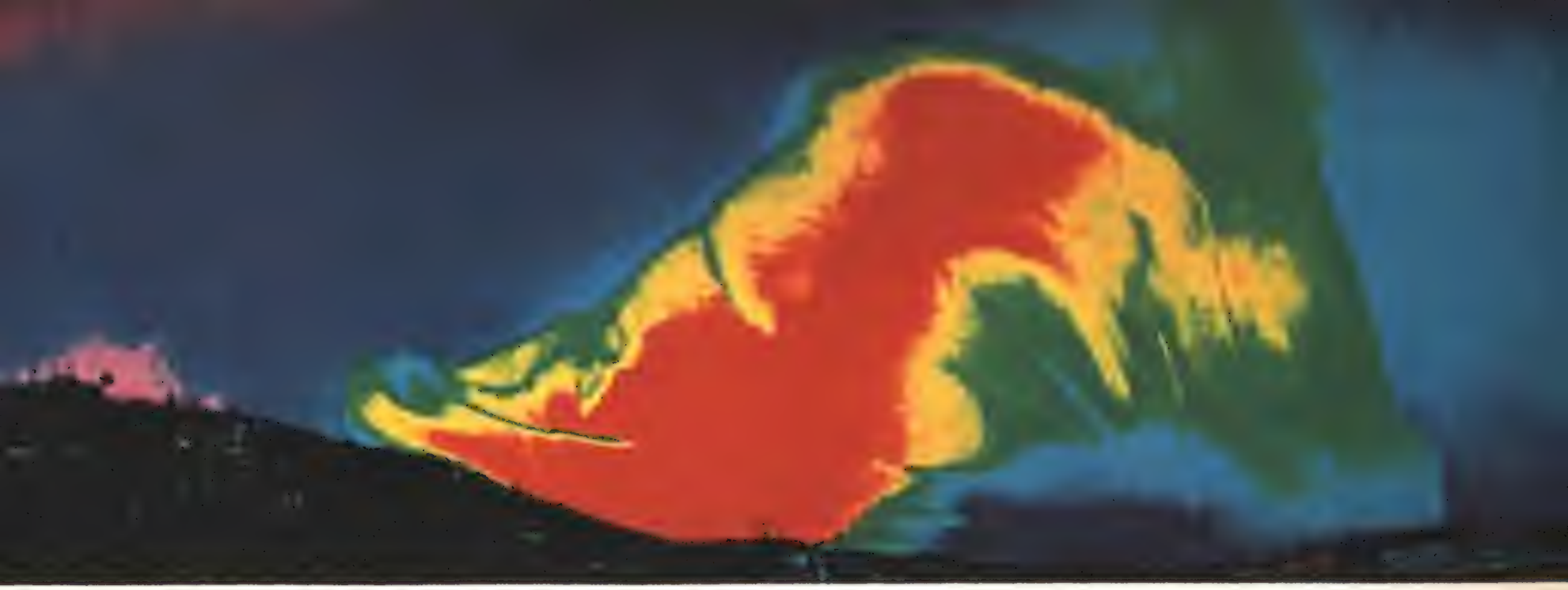
Brownouts. Blackouts. Radiation risks. Thermal pollution. All part of the new lingo in the conflict of a society which demands unlimited supplies of electrical energy and, at the same time, a sound environment. As more and more of us grow increasingly dependent on greater and greater amounts of energy, this conflict emerges as the central environmental issue the nation faces. One controversy in this Chinese box of controversies is hot water—the billions of gallons of hot water discharged by power plants.

Whatever it is called—thermal pollution, thermal effects, even thermal enrichment—environmentalists are rallying to stop it before it starts. A group of some three dozen Cornell professors waged a no-surrender fight beginning in 1968 against an 830,000-kilowatt nuclear power plant, which was already involved to the extent of five million dollars in preliminary site work on Lake Cayuga's shores. The plant was "indefinitely postponed," while the utility building it studies alternatives of disposing of its cooling water.

Across the country in Oregon, environmentalists led by the National Wildlife Federation lobbied for strong state water temperature standards. They were set so strictly that the one-million kilowatt Trojan nuclear plant, which had been designed to discharge its waste-heated water into the Columbia River, would have had to shut down for at least 43 days in the summer, when the water is naturally warmer, to comply. Now, rather than have a $200-million investment lay idle for more than a month each year, the utility is building cooling towers to recirculate waste water.

Mass dumping of waste heat is not yet common practice, and anxiety about thermal pollution comes less from current conditions than from what could be. Concern has crystallized around the electric power industry—the major thermal polluter, accounting for more than 80 percent of all water used for cooling. Most of the remaining 20 percent is used by a variety of private industries.

The magnitude of the problem is nearly incomprehensible. Electric power needs have doubled every ten years since 1945; the rate of increase will continue—and perhaps even grow—in the next few decades. To meet this need, according to the Federal Power Commission, the electric industry needs to install nearly one million megawatts of new capacity between now and 1990. One megawatt is 1,000 kilowatts. Most big nuclear plants now being built range between 500 and 1,200 megawatts, and a typical one-million kilowatt (or 1,000 megawatt) plant needs 850,000 gallons



In these aerial images, the hottest water shows red. Next is yellow, then green, cyan, blue. Magenta is the normal temperature of the water.

of water *a minute*, almost 1.2 billion gallons a day. With present technology, by 1980, one-sixth of the United States' fresh runoff will be used for cooling, *one-third* by the end of the century.

For now, electric power heat loads are localized, but as the electric power industry grows to meet the fantastic demands, the thermal pollution problem will intensify throughout the country. One scientist quipped: "At the rate they're proposing to build nuclear plants on the Hudson River, soon they'll be using each other's hot water."

This potential scene sends shivers down the spine of the Atomic Energy Commission's director of environmental affairs, Joseph Di Nunno: "Ten plants on the same lake or river may not hurt you. Eleven may not. But somewhere you'll put in just one more plant and you'll get pushed over the edge."

There's a nuke in your future

Whether we like them or not, there will be more nuclear plants in our future. Today, only 21 nuclear power plants are operable, but 93 are either under construction or in the planning stage, and within the next 30 years the A.E.C. envisions 950 in operation. In terms of national generating capacity, the "nukes" today account for less than two percent, but the A.E.C. sees this source for power mushrooming to 60 percent by the year 2000.

While nuclear power generates electricity more cheaply than fossil-fuel plants, they work less efficiently. The nukes (not to be confused with military slang for bombs) operate at about 32 percent efficiency (versus 40 percent for fossil fuel). For every three units of heat formed, one unit produces electricity and approximately two units are discharged as waste.

And here is where the nukes get in hot water: They require about 50 percent more cooling water than do fossil-fuel plants of equal size, and that water gets as much as 20 percent hotter. In addition, the nukes—hailed as the clean source of energy—send out all their waste heat as hot water. Fossil-fuel plants divvy it up, sending about 80 percent of their waste heat into the water while the rest goes up the smokestack into the atmosphere along with 20 million tons a year of fly ash, sulphur dioxide, nitrogen oxide and carbon monoxide.

Thermal pollution is minimized somewhat as each generation of nuclear power plant becomes more efficient: Early plants such as Yankee Power in Connecticut and Dresden I in Illinois operate at 28 percent efficiencies. And when nuclear breeder reactors are commercially available about 1985, they will produce steam at about the same temperatures and efficiency rates as fossil-fuel plants today.

But no matter which method used—nuclear or fossil fuels, conventional or breeder reactors—there will be waste heat, because of the thermodynamic process by which all electric plants presently work. Water is heated, forming steam, which is pushed under high temperatures and pressure to a turbine. The steam puts the turbine into motion, which drives the generator to produce electricity. After leaving the turbine the steam goes into a condenser where it gives off its extra heat, which is carried away by the cooling water, now an average of 15 degrees hotter.

The nuclear power proponents protest that they are being judged a priori on the thermal pollution issue. A study done for the A.E.C. on thermal effects on fish in the Columbia River near the Hanford nuclear plant

Formerly with Time, *free-lance author Jane Stein has written widely in the field of environment and science, including an early article on the SST and recently a piece on genetic engineering.*

in Washington concluded that there was no *direct* damage to salmon and trout when they swam through a heated section of the river: The fish continued to migrate and went on to spawn and populate. The A.E.C.'s chairman, Nobel prize-winner Dr. Glenn T. Seaborg, has attacked the conservationists as "doomsday prophets" who calculate how we will "boil" all our rivers and lakes after we have "cooked" all the fish in them. But, as the A.E.C. study showed, fish don't die from scalding in our waterways.

However, a longer-range study of Columbia River salmon, done by the Western Fish Toxicology Station of the Environmental Protection Agency produced distressing results. In water heated to 68 degrees F., the maximum the state permitted for industrial wastes, all of the salmon died within a month—usually before they could spawn. The fish had died of diseases promoted by the warmer temperatures: Diseases were found to be a problem even at 62 degrees F. The study also pointed to a more complex problem that awaits further research: the interaction of chemical pollution loads with thermal loads.

There are known lethal temperatures for fish—different ones for different species—but the range and effects of sublethal temperatures are still unclear. Heat, for example, speeds up the metabolism of fish enough to double their consumption of oxygen for each ten-degree rise in water temperature. But as water warms up, it can hold less oxygen—in an inverse proportion, as the supply decreases.

The effects of temperature on reproduction of aquatic animals is striking. Some species spawn in the fall when temperatures drop, many more species spawn in spring. For these fish, rising temperatures can cause the females to deposit their eggs in the water earlier than under normal circumstances. Some fish eggs hatch quicker in warmer water, some eggs won't hatch at all if incubated in water that is too warm.

Shrimp, raised in water heated by Florida's Turkey Point power plant, are fed.

A bewildering array of effects

Excessive temperatures could prevent normal development of eggs in some species; a thermal barrier across a river or stream can prevent some fish from swimming upstream to spawn, or from passing safely downstream to carry out their life cycle. By designing an area known as a mixing zone—in which the hot water mixes under controlled conditions with the water in the stream—it may be possible to keep a passageway open for fish to swim by the hot area.

Temperature affects not only fish, but all aspects of aquatic environment. Bacteria deadly to certain fish are apt to thrive in the warmer waters of one river, while in another hot water harms bacteria that help cleanse the water, thus spurring the growth of noxious blue-green algae. Hot water also causes eutrophication (overfertilization characterized by depletion of oxygen and excess of plant nutrients), increases evaporation (which can lead to increased sedimentation) and tends to make water turbid (which decreases penetration of sunlight).

The consequences of pouring billions of gallons of heated water into a body of water are not completely known. But evidence accumulates that it is ecologically dangerous to assume that because we don't know, we can move right in.

"It is a sad commentary, but too often true, that the inability to prove damage becomes license to pollute," says Thomas L. Kimball of the National Wildlife Federation. "Users should be required to furnish

proof that there will be no detrimental effects to the environment as a result of their activities."

Until this year, quite the converse was true. While the A.E.C. granted construction and operating licenses for nuclear power plants, they long contended that thermal wastes were not its concern, even to the degree that they wouldn't allow environmental effects to be discussed at hearings. Now that they do, they defer the matter to the states. According to 1970 federal legislation, before the A.E.C. can issue a license, the utility company must have state, regional or federal certification that the plant will comply with water quality standards. The drawback here, as conservationists see it, is that although they are getting tougher, the states have a history of setting weak standards.

Thermal pollution is one of the few environmental problems that can be stopped before it starts, and public-action groups have amassed an impressive record of trying to abate the problem. Local environmental groups and national organizations have been the forces behind delays of more than a dozen nuclear plants, for any combination of reasons: thermal pollution, fears of excessive radiation, inappropriate siting, unsightly transmission lines. And the tool they use is the lawsuit.

Litigation has held up the opening of the 700,000-kilowatt Palisades plant on Lake Michigan while the utility company and environmentalists argued about thermal and radioactive wastes. Nine months after the plant was completed—with Consumers Power Company losing $105,000 each day the plant was idle—the company agreed to build cooling towers, and to upgrade its radioactive waste system to eliminate leakage into the Lake.

Tough standards for Lake Michigan

Nuclear plants on Lake Michigan pose a unique problem, because seven, including the Palisades plant, are planned or under construction. Fish and Wildlife Service experts calculated that without thermal restrictions, the heat inputs into the lake from these plants could increase ten-fold in the next 30 years which would be more than enough to ruin the Lake's extensive fish and plant life.

The federal government has tackled the Lake Michigan problem since last spring, when the Federal Water Quality Administration (now part of the Environmental Protection Agency) forbade the dumping of virtually any heated water into the Lake. Since then, three of the four states have joined the E.P.A. setting local standards that would prevent the discharge of any heated water into the Lake that would raise the temperature three degrees above normal at a point 1,000 feet from the discharge pipe. This will force all

Only an interim solution, "forced draft" cooling towers shown in western Virginia: Fans pull air through the sides and across the hot water which gives up heat by evaporation.

shoreline power plants, including the new ones, to upgrade their cooling facilities. Illinois, while not setting equally stiff thermal-pollution standards, has ruled against the construction of any new nuclear plants along its Lake shoreline.

In another move the federal government sought court action against the Florida Power and Light Company to stop present and threatened thermal pollution. Two 651,500-kilowatt nuclear power units at Turkey Point in Biscayne Bay in Florida, working in tandem with two already operating oil-fired units, will discharge almost 12 million gallons of heated water per minute, the equivalent of 1,800 acres, four-feet deep, each day. The average depth of the Bay is only seven feet. With water temperatures recorded as high as 102 degrees F., damage from the oil-fired units has included scorching 450 acres of Bay bottom. The maximum legal discharge temperature in Dade County is 95 degrees F., a level federal officials have testified is fatal to many life forms. At that, Dade County has given the utility permission to exceed 95 degrees F.

After filing a suit last spring, the government attempted and failed to get a preliminary injunction to

stop Florida Power and Light from discharging waste heat from their fossil-fuel plants. The company has been studying different cooling devices and will discuss them with the government in pretrial hearings.

The two 800,000-kilowatt Calvert Cliff plants planned for the Chesapeake Bay in Maryland provoked a fight lasting more than two years by environmentalists over thermal pollution and radiation leakage. The Baltimore Gas and Electric Company finally did get their construction permit (after work was more than 30 percent completed). But what the environmentalists labored hard for and won was a stipulation on the permit requiring the company to install new pollution controls as they become technologically available. And it is this clause that the conservationists plan to use in their next round of attacks on the plants.

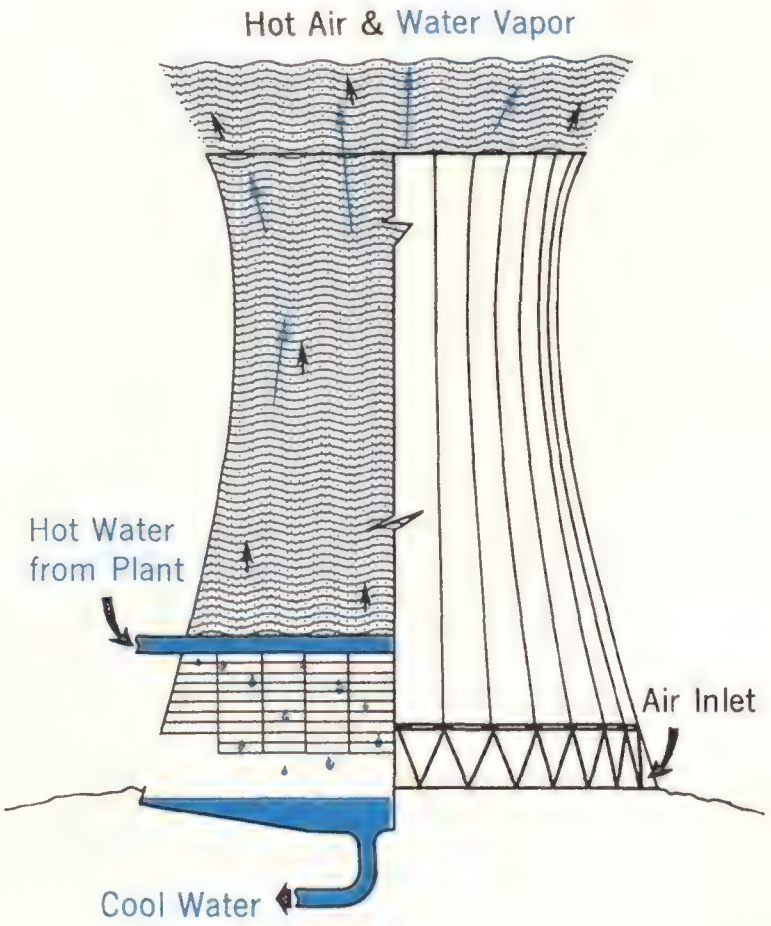
Doing something with leftovers is one of the new ways of coping with pollution. Why not use waste heat in buildings, pipe it under highways or airport runways in northern areas and eliminate the need for snow removal, farm warm-weather fish in it, irrigate crops with it and lengthen the growing season? Some of this can and is being done. The city of Tapiola Garden City, Finland, with a population of 20,000 gets both hot-water heating and electrical power from the same fossil-fuel steam plant.

In Iceland, geothermal discharges have been used for 25 years for heating and industrial uses for the 80,000 persons in the capital, Reykjavik. In suburban Stockholm, the Swedes use waste heat from a small nuclear plant to heat an apartment project. And in the United States, the first large dual-purpose nuclear plant is being built at Midland, Michigan, which will send its steam to nearby Dow Chemical Company for use in chemical processes.

Using waste heat, however, has inherent economic limitations. While it is hot enough to be an environmental nuisance, it is not hot enough to be of much use. Most of the water discharged by a power plant is between 90 and 100 degrees F. In contrast the steam-space heating system in Reykjavik uses water at 194 degrees F., and chemical companies cannot use heat much lower than 180 degrees F. To take high-quality (hotter) steam from the steam cycle instead of from the cooling water is no longer using waste heat.

A suggested source of using low-quality heat is for agriculture and aquaculture. A demonstration project is underway in Oregon to show that warm water—in this case, piped in from a paper mill—when sprinkled above early buds, blossoms and young fruit can protect them from early frost. In another project in Oregon, corn grew one foot taller and green beans grew faster and fuller in soil heated by electric cables, simulating a system of underground pipes carrying hot water from a hypothetical nuclear power plant.

Agriculture, however, cannot use the enormous quantities of warm water a one million-kilowatt plant discharges. Irrigation is needed only a few months during the year; frost control, only a few days. A power plant's discharges are nearly continuous.



In the "wet" natural draft cooling tower, air rises, cooling the hot water by evaporation. Hot air and a plume of water vapor are emitted from the top, alarming many environmentalists.

Aquaculture with waste heat has already been carried out in small pilot projects. University of Miami scientists have raised shrimp in warm power plant wastes in Florida, and oysters are being cultivated in Long Island Sound. Successful as these projects are, they are a long way from large-scale production. Beneficial uses of waste heat, then, are currently neither economical nor practical and do not seem to promise a broad-scale solution.

But thermal pollution can be controlled today—and with today's technology, according to Frank H. Rainwater, chief of the federal National Thermal Pollution Research Program. Most nuclear power plants use once-through cooling, a relatively inexpensive system that costs three-to-five million dollars to install: Cooling water is taken from the nearby waterway, passed once through a condenser where the waste heat is converted to heated water, then ejected back to the waterway some 15 degrees warmer.

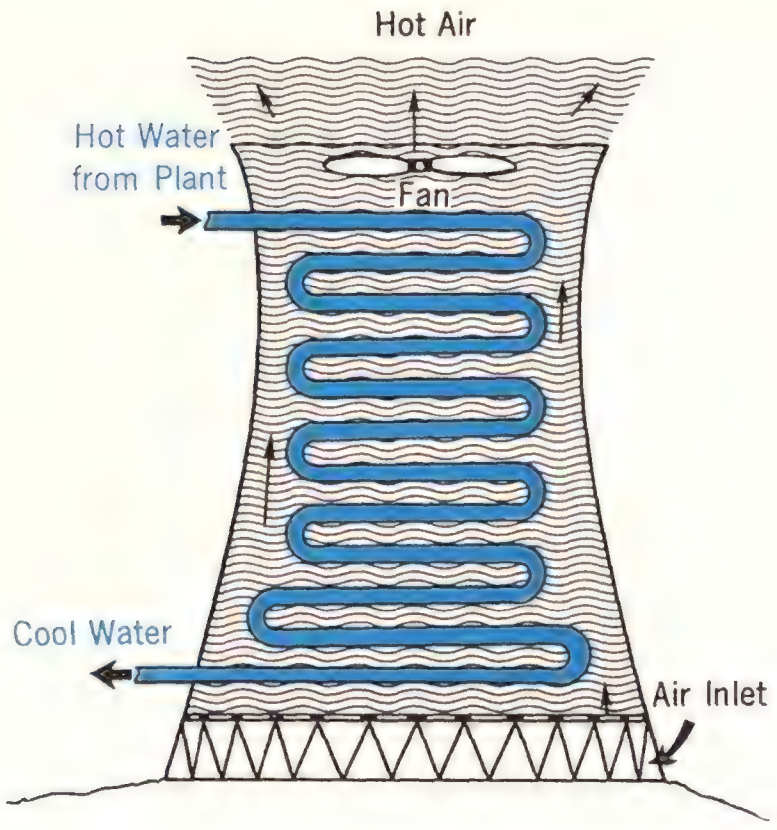
There are ways to lower the heat while still using the once-through method. Jet diffusers spray the warmer water into the cooler water, promote the mixing of the two and cut the temperature by one-third. Pumps take water from the stream and mix it with condenser water before it enters the stream itself, roughly cutting the temperature of the heated water in half.

A better solution is to recycle the cooling water—which is what cooling towers can do. In these huge concrete structures—some go as high as 500 feet and are more than 300 feet in diameter at the base—the heated water is dripped over a lattice work in the tower. In one version, the natural draft, cool air enters through the bottom and carries moisture-laden heated air out the top.

Mechanical draft cooling towers operate much the same way except that giant fans do the work of the natural flow of air. These towers are called "evaporative" types because some of the water evaporates into the air. Most of it collects in a basin—cooled to its original temperature—and is pumped into the waterway or recirculated to the condenser.

Yet another type of tower is the dry type in which no water escapes from the recirculation system. It goes through a heat exchanger, much like the water-cooling system used in automobiles: Hot water is channeled through tubing, which is exposed to an air flow caused by either natural or mechanical draft. This type of tower, two-and-one-half times as expensive as the wet type, has not been used on any of the large power plants in the United States, but is in use at Rugeley Station in England.

In April, General Electric announced a new design for a cooling tower—a hollow structure 60 feet tall and 600 feet in diameter. It would resemble a modern sports stadium but would be a third its height. The advantage claimed by General Electric for its new design is that the waste heat would rise more slowly, and therefore to greater altitude—so high that it would pierce the inversion layers that often occur over U. S. cities thus ventilating the air aloft.



In the more expensive "dry" cooling tower, the plant's hot water passes through tubing and loses heat to the rising air with no evaporation. No American power plant has yet built one.

Cooling devices and heat islands

Another solution may be a cooling pond, which can be built only where a great deal of land is available: A one million-kilowatt plant requires a 2,000-acre lake. Artificially impounded waters form the pond for once-through cooling. Since the pond is man-made, the added hot water cannot harm the "natural" ecology of the water body. In fact, warm-water fish thrive there.

But towers and ponds are not without problems. While the design of hyperbolic towers may be esthetically pleasing, the structures do, nevertheless, soar into the air high enough to provoke public outrage. More critically, a tower for a one-million kilowatt plant would dissipate to the air some 20,000 to 25,000 gallons of evaporated water a minute.

Critics have charged that this water—the equivalent

Hot water

of a daily rainfall of an inch on an area of two square miles would cause low-lying fog and ice. And when a tower uses ocean water, the salt spray ejected from a single plant could destroy vegetation over an area of 160 square miles. Cooling towers can be turned off during periods of bad weather, but ponds, continue the challengers, continually dissipate heat to the air even on hot humid days.

Contrary to popular opinion, most of the evidence from towers and ponds now operating show minimal effects on local weather from putting all that water into the air. A group of air and water pollution experts from Oregon and Washington toured four power plants with cooling towers and one with a cooling pond in Appalachia—deliberately in late December when the worst weather conditions prevailed. They found that the towers did not contribute to local ground fogging or icing conditions despite heavy natural fog, and while fog did hang over the cooling pond, it did not carry over to an adjacent highway.

While water vapor from cooling towers does have an effect on the environment, according to the results of a National Air Pollution Control Authority-supported study, this effect is limited and reinforces natural phenomena, such as formation of cumulus clouds that would occur anyway.

"For some reason natural towers do not create significant fog, even though the law of physics indicates they should. I wish I could say otherwise," reported the project engineer of an atomic power plant going up near Cincinnati—with expensive cooling towers.

Cooling towers have also come under attack as being too costly. The costs to a utility company would run from $8 million to $13 million for wet cooling towers and as much as $25 million for the dry types (versus $3 million to $5 million for once-through measures for a one-million kilowatt nuclear plant). But the costs of these towers, when passed on to the consumer's bill, would add less than one percent for a wet tower, five percent for the dry type. On a $15 monthly bill, 15 cents is hardly an exorbitant fee.

Nonetheless, cooling towers seem to be the best solution for the time being. Only 28 percent of the nuclear power plants planned or operating today have them; 11 percent have cooling ponds, while more than 60 percent cling to once-through cooling. The inclusion of these towers, it must be noted, has generally come only after a fierce battle with conservationists, where state water-quality laws make them necessary because of stiff thermal standards, or where there is little available natural cooling water.

Yet one must wonder what cumulative meteorological effects would result when 30 years hence, thousands of towers were cooling the equivalent of one-third of the nation's fresh runoff, and ejecting vast quantities of heat and evaporated water into the air. Indeed the recent Study of Critical Environmental Problems, sponsored by Massachusetts Institute of Technology warned of "heat islands" in the air over cities and serious climatic effects from too great an addition of water vapor to the air.

A new symbol for an age

The long-term solution to thermal pollution lies in finding alternative ways to get power—and by taking a hard look at the projected levels of energy consumption. Among the alternatives now talked about is magnetohydrodynamics, a way of converting coal and other fossil fuels to electricity almost directly. No large magnetohydrodynamic plants have been built in this country, but researchers estimate that such plants might reach thermal efficiencies of 60 percent.

Another alternative is nuclear fusion which, with some 30 years more of research, could result in direct energy conversion with 90 percent and above efficiencies, all without thermal wastes. But federal spending for fusion, long a low-priority item, has recently been cut, delaying the "clean" reactor development.

But until and unless these possibilities become realities, thermal pollution will have to be controlled by use of cooling towers. As public pressure mounts and as water-quality standards become stiffer, the shadow of the cooling tower may well replace the smokestack as the omnipresent symbol of industrial development.

Past and future: Seen alongside the tall chimneys of a coal-fired power plant near Pittsburgh, the steaming hyperbolic cooling tower will surely become a familiar feature of the landscape.

By Mary Sayre Haverstock

Two hundred years of rewards, defeats and butchers' bills

What it is like to be an artist in America is vividly revealed in the Archives of American Art, now at the Smithsonian

The Metropolitan Museum of Art, Wolfe Fund 1906

Not everybody, perhaps, would really care to know what Winslow Homer had in mind when he decided to paint *The Gulf Stream*. After all, a painting like that is perfectly capable of standing on its own merits. Nevertheless, there are many people who not only find the subject of Homer's intentions deeply interesting, but also would be delighted to know what he ate for breakfast that day, not to mention whether the breeze was up and the tide was high.

To people like us, one such item is worth a dozen generalizations. Some are genuine scholars who will someday make their own generalizations. Some are critics, biographers, art collectors, museum curators or doctoral candidates. And some of us are merely "trivia freaks," or people who revel in reading other people's mail—even dead people's. But we are all fascinated by the big and little facts, the rare firsthand observations, such as the sketch by Waldo Peirce on the cover and the picture captions in this article, without which art history (or any other history) tends to become verbose and abstract.

Until recently this sort of material was extremely hard to come by. One had to talk one's way into the parlors of dead men's heirs or journey to distant cities and towns. One had to visit any number of manuscript libraries, some relatively accessible to scholars and

Mrs. Haverstock's articles have appeared in Art in America, A.I.A. Journal *and other publications. She is currently writing a book about George Catlin.*

Winslow Homer, *The Gulf Stream*, 1899. In a letter to his dealer, now in the Archives, Homer wrote: "They *have been blown out to sea by a hurricane*. You can tell these ladies that the unfortunate Negro who now is so dazed and parboiled will be rescued and returned to his friends and home, and ever after live happily."

Archives of American Art, Rockwell Kent Papers

Not Rudolph Valentino but the American painter Marsden Hartley, noted for austere landscapes and still lifes, is pictured in fancy dress in Paris in 1913. He inscribed it: "This is yours humbly—after the Society Arts Ball, 7 a.m."

others too remote or otherwise unapproachable.

The Archives of American Art, now installed in the library of the Smithsonian Institution's National Collection of Fine Arts and National Portrait Gallery, is changing that. In eight yellow file cabinets it contains a microfilm record of every aspect of American art from the 18th century to the present. Here, wound on 3,000 plastic spools, are the aspirations, joys, triumphs and disappointments of countless American artists, unknown as well as famous. The diary of Whistler's mother is here, along with snatches of the mystic poetry of Albert Pinkham Ryder, leftover invitations to glittering parties, mundane invoices for paints and canvas, and unexpected snapshots of painters at play.

This unparalleled array of Americana is the result of a project begun in 1954 by two men who, more than most, recognized the need for a centralized research facility for American art. One was Lawrence A. Fleischman, an adventurous Detroit art-lover who itched to know more about the works in his own collection. The other was Edgar P. Richardson, then director of the Detroit Institute of Arts, who was hard at work on the most comprehensive survey of American painting ever attempted—and having a difficult time locating the information he needed.

A trove of five million items

Through their efforts the Archives of American Art has grown from a part-time activity at the Detroit Institute of Arts to a trove of more than five million items, gathered from public and private sources all around the world, and available to scholars not only in Washington but also, in duplicate, in branch offices in New York, Boston and Detroit.

If anyone, on that fateful day in 1899, made a note of Winslow Homer's breakfast, the Archives may eventually discover the document and put it in the record, for Archives staff members and hard-working volunteers are systematically filming everything they can get their hands on.

"Our chief goal," says William E. Woolfenden, director of the Archives, "is effective and widespread service to scholars. We achieve this goal by finding and preserving the basic documentation they need for research in all aspects of the visual arts in America."

Anyone with the slightest curiosity about this country's artistic heritage would have to agree that the Archives is doing that. One could spend a month just compiling catty remarks, such as the assessment of John La Farge by one of the founders of the Boston Museum of Fine Arts, Martin Brimmer: "With a half-trained man of genius one can never be sure of anything." Or Jervis McEntee's comment, on hearing that the 19th-century landscape painter Frederic E. Church

Archives of American Art, Abraham Walkowitz Papers

Lunch in Mt. Kisco, 1912. From left: unidentified man, Mrs. Eugene Meyer, Mrs. Alfred Stieglitz, Alfred Stieglitz, dealer Paul Haviland, painter Abraham Walkowitz, Catherine Rhodes and painter John Marin.

and his wife had gone to the theater: "I thought they only attended prayer meetings." One could also write a history of artistic etiquette. Of a lady who habitually kissed everybody, the same Mr. Brimmer confessed: "I hate it. I dread it. . . . It gives me the blind staggers."

In another vein, one could make a revealing survey of the vocations American artists have turned to in hard times, such as raising chickens, engraving bank notes (John Frederick Kensett) and designing wallpaper (Charles Burchfield).

One could even set out to decipher the handwriting of John Singer Sargent, which would be on a level with cracking the hieroglyphs of the ancient Maya. (A typical line, chosen at random from Sargent's voluminous correspondence, seems to read, "Squee twick horror blib twoll fip noddy ba.")

But the main purpose of the Archives of American Art, as Mr. Woolfenden points out, is to provide the source materials for books, articles and dissertations. Thus, two recent works on the sculptor David Smith have been based entirely on Archives resources. And a biography of the important black painter Henry O. Tanner, a definitive account of the Armory Show of 1913, a history of the 19th-century artist in American society, several doctoral dissertations on government sponsorship of the arts in the 1930s, as well as many other studies, have all depended heavily on documents preserved by this new Smithsonian bureau.

Chronologically, the material in the Archives begins with a 1743 letter by John Smibert (1688-1751, the first American portraitist), and goes on to trace the fortunes of American artists through more than two centuries of struggle, success and disappointment, exposing many a human failing along the way.

One of the most interesting early documents is a hearty, cheerful letter from Benjamin West, mailed from London to Charles Willson Peale in 1783. It is particularly remarkable because at the time there was hardly anyone closer to the innermost circle of George III than West, who arrived in London before the Revolution and stayed on to become painter to the court and president of the Royal Academy. "Before I proseed any fearther [sic] with this letter," he wrote, "lett me congratulate you and my Countrymen in general, on the event of the Peace and the fortitude that they have shown during the unhappy war."

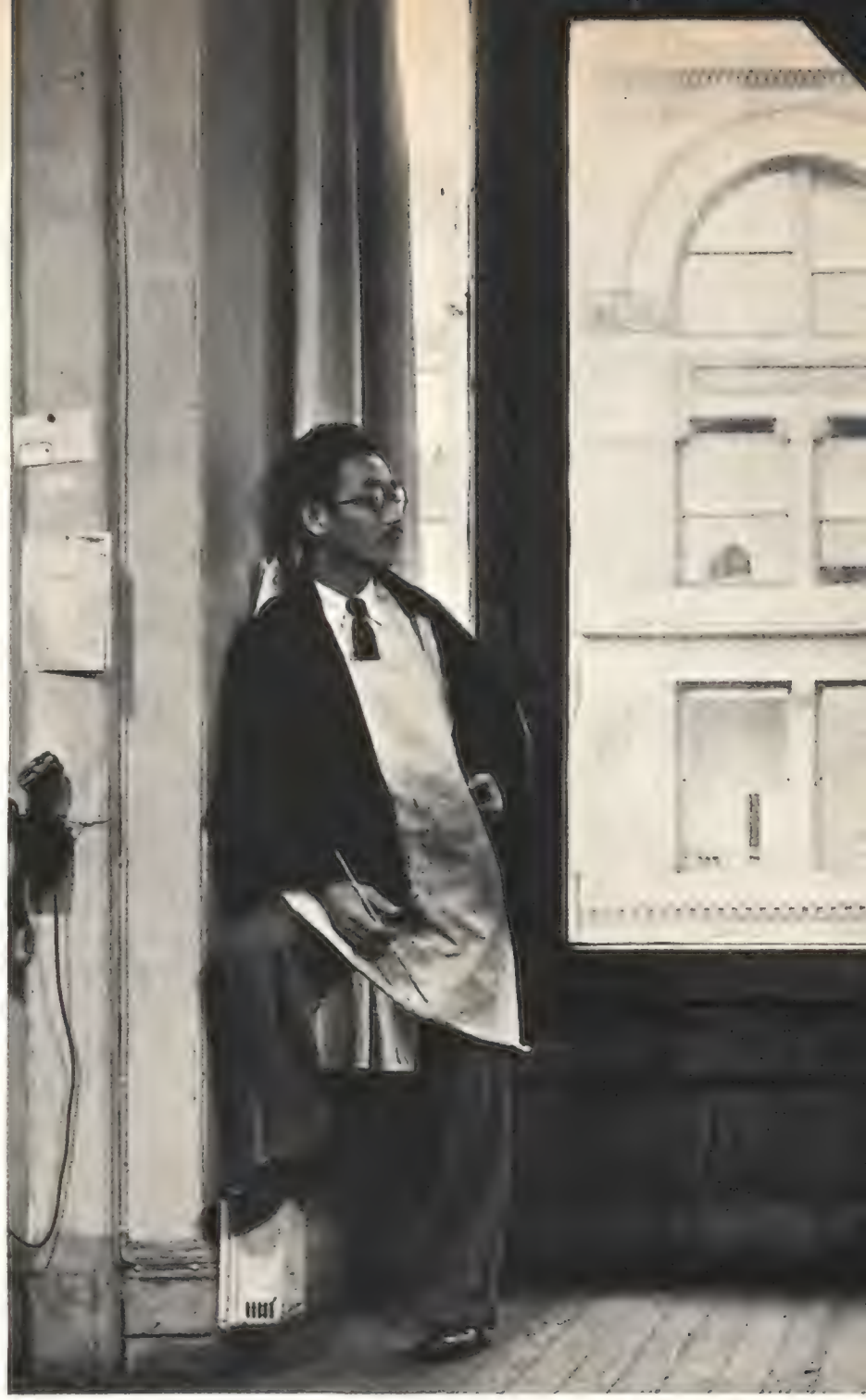
Although he could well afford to patronize his former compatriots, West was, like every other artist before or since, beset with personal problems. His letters in the Archives almost never fail to bring up the subject of his gout. Moreover, he had a son who apparently demanded the best out of life. Raphael West writes to his father in 1818 that his rent is two years past due and that his debts have reached a grand total of £556, including impressive sums owed to the wine merchant, the brewer, the tinsmith, housepainters, carpenters, bricklayers and shoemakers. In closing his three-page accounting, Raphael rather dryly adds: "Your letter containing the three one pound notes I safely rec'd & for which I am greatly obliged to you."

Back home, painting portraits was the artists' chief means of livelihood, and Philadelphia was where the customers were. Charles Willson Peale and his numerous talented children set the city's highly civilized tone, and for a time the arts flourished there. Thomas Sully, however, found its working conditions far from satisfactory, and submitted a "Memorial" to the city fathers in 1817: "The undersigned, petitions that the present Stand for Hackney-coaches, in fifth street, at the south-west corner of Chestnut and fifth streets; may be removed elsewhere. The residence of your memorialist is in the Philosophical Society; the steps to the entrance of which House, and pavement before the door, is constantly occupied by Hackney-coachmen; whose insulting behaviour to those who pass them, is highly injurious to the professional pursuits of your memorialist. . . ."

When necessary, a competent painter could even turn out a portrait of a dead man—although this presented some problems. William Sidney Mount wrote to Charles Lanman in 1853: "My dear Sir, Please concentrate your mind, and bring before you in his most happy moments the form and face of your late friend, the Hon. Daniel Webster. . . . Let me know his height—the color of his skin, eyes, hair, dress, style of shoes, or boots—his manner of standing while making a speech, if he used his arms, and hands much, and on which side he dressed his pantaloons. . . ."

No easy life for the artist

There is ample proof in the Archives that the artist's profession in the 19th century could be a harsh one. Among the scores who finally abandoned the fight was Samuel F. B. Morse, who quit painting not long after he wrote to his friend S. De Witt Bloodgood: "I am in perfect health of body and yet I would fain think that something in the physical system is wrong, to produce such settled conviction of hopelessness. No, Bloodgood, the causes are tangible, palpable: my profession is that of a *beggar,* and it exists on *charity*. . . ."



Painter Yasuo Kuniyoshi in his New York studio, photographed by Yanno for the Federal Art Project.

Morse did not have to settle for sour grapes; he went on to invent the telegraph. But many American artists were not so fortunate as to find a new and prosperous niche. There was John Trumbull, who started out as a "historical" painter much sought after by the Congressmen who parceled out the acres of wall space in the U.S. Capitol, but who was soon dropped by his sponsors because of excesses of temperament on and off the job. By 1835 Trumbull was so embittered that he spurned an offer of membership in the prestigious Massachusetts Historical Society. "There is a time for all things," he wrote. "If this mark of attention had been paid to me some forty years ago . . . I should have been flattered—but now my labors have received Obloquy and Abuse in place of approval—& where the frosts of Seventy nine winters have...chilled my Enthusiasm—I am only desirous of quiet. . . ."

The middle years of the 19th century saw American artists on the move, and the Archives chronicles their

Archives of American Art, Federal Art Project Collection

travels. The sculptor Hiram Powers embarked for Italy in 1837, complaining afterwards, "Our situation during the voyage in some respects was not the most agreeable. The ship leaked a good deal and both our eyes and ears were annoyed by the frequent pumping." When Powers got to Florence he found the dean of American sculptors, Horatio Greenough, working at —of all things—busts of Boston ladies.

And Emmanuel Leutze set off for Düsseldorf, where he tackled the subjects of *Washington Crossing the Delaware* and *The Battle of Monmouth*. Grossly underestimating the eventual popularity of his paintings, he wrote from there: "I shall always endeavour in my pictures to preserve the truth as I hope they may be more than mere decorations and may bring a bright example to the heart of some future youth."

All of these artistic junkets were, of course, expensive. William Page, a painter of considerable originality whose long-suffering brother-in-law was helping him to keep afloat in Europe, received many exasperated letters, of which this is typical: "High art and naked human female figures are all well in their places, but the first and only thing for you both to do *now* is to go into a still *higher art* of getting out and keeping out of debt. . . ."

Meanwhile the promise of government patronage was bringing many hopeful artists to Washington. Thomas Crawford in his letters to his wife expressed outrage at the favoritism he encountered in Capitol corridors. About his arch rival, Hiram Powers, he wrote: "Is there any reason under heaven why I should sit down quietly and see this reign of mediocrity—this newspaper reputation with its air of innocence having full sway over not only me but every sculptor in America?" (Crawford was to make the grade eventually. His bronze statue of Freedom presides over all of Washington from the top of the Capitol dome.)

But times were getting better

Succeeding generations of artists saw their fortunes rise with the fortunes of the country as a whole. Frederic E. Church was able to raise his prices—he charged by the square foot—and in 1860 G.P.A. Healy was getting $1,000 for a "grand size" portrait.

By the latter part of the 19th century, the correspondence of American artists begins to show a lessening of past anxieties, a certain air of leisureliness and more than a touch of pomposity. The arts were prospering as never before, and the public poured into the galleries and studios, scattering invitations to teas, receptions, balls and musicales. Jervis McEntee, a painter of the Hudson River School who lived and worked in the famous Tenth Street Studio building in New York, writes in his diary in 1873: "We had a reception at the Studio Building today which seems to have been a success so far as numbers and respectability of the visitors is concerned. The wealth of New York was out in full force (and its ignorance of art too)." Basking in their new glory, the artists no longer hesitated to express their opinions on every conceivable subject, art among them.

Thus Abbott H. Thayer, in a note to his patron, Charles Lang Freer (who endowed the Freer Gallery of Art in Washington), expatiates on the philosophical aspects of portrait painting: "The strain to suit the relatives on the one hand and the muse on the other—without failing the muse—would soon drive me mad. Every picture I do racks me anyway, very much as the over-large engine in one of Herreshoff's 30 knot yachts racks the craft." Descending to earth, Thayer asks—somewhat improbably—in his next letter to Freer: "If you hear of a pair of prairie dogs . . . that could be got for us, and shipped on in a box full of carrots,

National Collection of Fine Arts

Thomas Eakins, *Annie Williams Gandy*, c. 1903. Some lecture notes in the Archives reveal his feelings about his peers: "There is too much common, ordinary work. Respectability in art is appalling."

send them, and rejoice the Thayer family from me down. . . ."

Now that artists were getting so much public attention, they found that they had to contend with the press. Eastman Johnson was near apoplexy over a careless quotation included in a memorial volume for Henry Ward Beecher published in 1887 by Edward Bok. "I have no record of what I said," he fumed, "but I *know* I could not have written anything so stupid as this—'I am glad enough to add my name to the great and heroic things that Mr. Beecher has done.' I must ask of you to expunge that article from your book, and insist that you have no right to continue to insert anything so damaging to anybody's reputation for common sense." At this date it is hard to know why Johnson was suddenly washing his hands of Beecher, although it may have had something to do with the popular preacher's being sued for adultery.

The arrival of the professional art critic brought with it a storm of angry correspondence from artists rightly or wrongly slighted in the newspapers. But the art world and the world of journalism did not really lock horns until later, at the time of the celebrated Armory Show of 1913, when the American public first came face to face with the revolutionary work of Marcel Duchamp, the "crazy cubists" and the "wild men" of Paris (see page 60). The critics had a field day, but still the public came. As William Macbeth, then the leading New York dealer in American art, remarked: "It is difficult to understand why people who do not care for certain things, who, on the contrary, thoroughly dislike them, take the trouble to see them again and again, and to talk about them, in season and out of season."

Art as revolution—50 years ago

Things had not yet calmed down when the Metropolitan Museum mounted a smaller and tamer show of some of the same artists, only to be denounced as traitors to the Republic by an anonymous "Committee of Citizens and Supporters of the Museum" in the following terms: "We believe that these forces of so-called art are merely a symptom of a general movement throughout the world having as its object the breaking down of all law and order and the Revolutionary destruction of our entire social system." This was in 1921.

From this time on, artists had a clear choice: They could engage in confrontation politics against the public, the press and the whole society, or they could stick to traditional ways and their own business. And here, in the area of the recent past, is where the Archives is doing something unique: Rather than collect what somebody *now* thinks to be significant, the Archives is collecting anything and everything. It will be left to future users to decide what was really significant about the art we think of as contemporary.

In the nick of time, the Archives has been able to salvage an enormous amount of material from the Depression era, for example. Future scholars may yet be able to make some sense of what seemed at the time—and still seems—a chaos of memoranda and manifestos. The Treasury Department's Section of Fine Arts was one of the most productive programs, and one of the most difficult to administer, as its chief, Edward Bruce, was to discover. But his boss wouldn't let him quit. "MEMORANDUM FOR NED BRUCE" reads a 1939 communication. "What is all this nonsense about your contemplated resignation? When a fellow turns up in Washington and proves that he can make bricks out of straw, and that the bricks are durable and artistic and nobody else can make them, the President puts a Marine Guard around him and does not let him leave. Do be a good fellow and write . . . that you have been thus chained to the Government of the United States and cannot get away even if you want to. F.D.R."

After the Depression the sheer quantity of material in the Archives doubles and triples and quadruples. There are tape-recorded interviews with scores of con-

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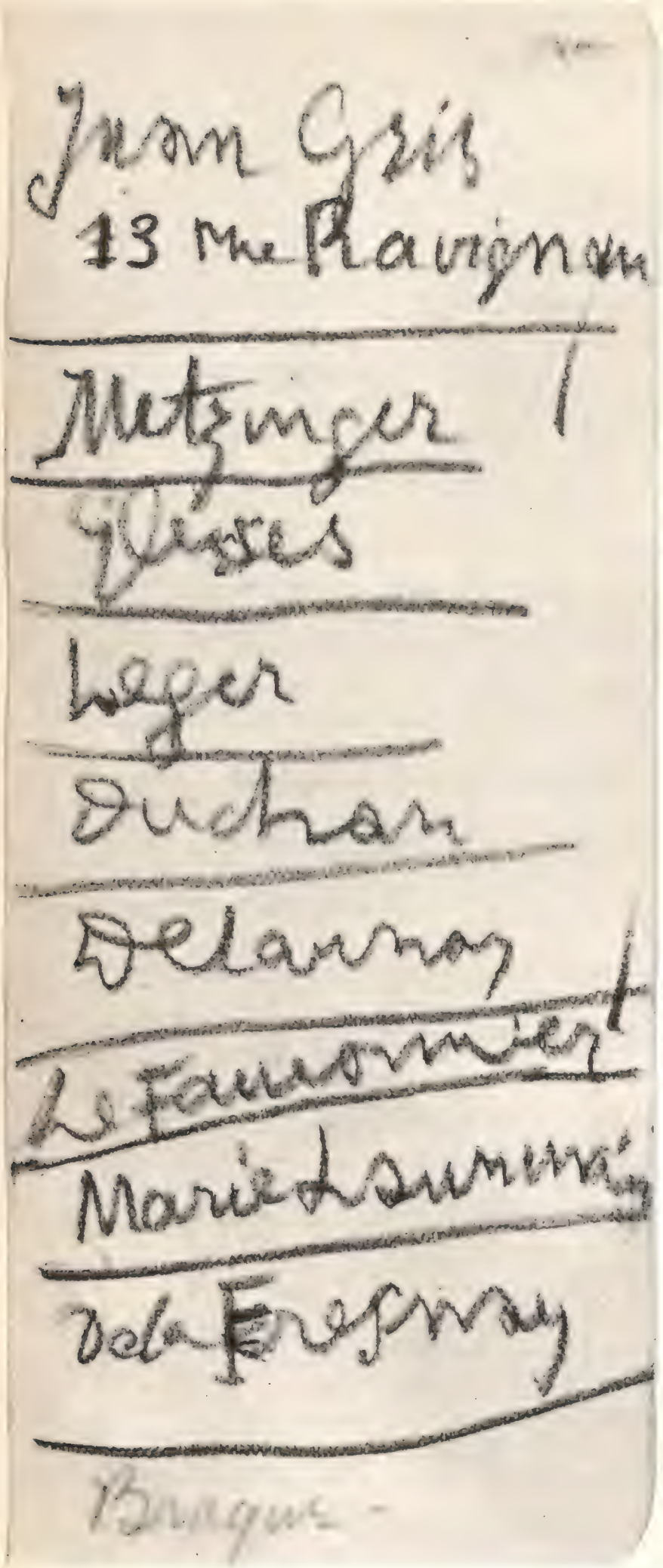
Archives of American Art, Walt Kuhn Papers



Picasso's list, in his own handwriting and spelling, of the French artists who should be included in the famous New York Armory Show of 1913: Juan Gris, Metzinger, Gleizes, Léger, Duchamp, Delaunay, Le Fauconnier, Marie Laurencin and La Fresnaye. American painter Walt Kuhn added Braque's name.

temporary artists and complete files of correspondence donated by art dealers, magazine editors and critics.

And yet, despite radical changes in artistic taste and in the society as a whole, despite the fact that the artist in America no longer needs to feel like a wanderer in the wilderness, even the most contemporary of them still sounds very much like his 19th-century predecessors. The late David Smith is widely thought of as the foremost American sculptor of this century. Not long before he overturned his truck and died in 1965, he wrote in his notebook:

"It would be nice not to be so lonesome sometimes —months pass without the acquaintance even of a mind, acquaintances are pure waste—why do I measure my life by works—the other time seems waste—Can the measured life by work be illusion?—yet this standard seems farthest from illusion of any measure. . . . If I walk fifteen miles through the mountains I'm exhausted enough to want to rest and the mind won't—enjoying nature is only occasional and not complete enough—but more so than artificial stimulations of jazz and bop and beer which race along without the mind and leave me feeling cheated—I hate to go to bed —to stay alive longer—I've slipped up on time—it all didn't get in—the warpage is in me."

No one can say how much private desolation is wound on the miles of celluloid along with all the auction prices, butchers' bills, doodles, catalogs, old wedding invitations and family snapshots in the Archives of American Art. Nor could anyone possibly measure the high good humor and free-wheeling boisterousness, the awful puns, the jibes, the spoofs, the good-natured digs that spin through the microfilm reels with heartening regularity.

Over the past few decades Washington has become almost embarrassingly rich in art treasures—it is second only to New York in the number and variety of its museums—but at the same time it has remained poverty-stricken in source materials for the study of American art. (It was only relatively recently, after all, that America was acknowledged to possess an art history *worth* studying.) Local scholars, long resigned to the gypsy life, are now gleefully tearing up their timetables and enjoying, for the first time, the luxurious feeling that whatever they may be looking for will probably turn up in the Archives of American Art.

Charles Burchfield, *Orion in December,* 1959. "I don't know how much time I've got left, but I'd like to have at least another lifetime like I've had to say what I want about nature. I just don't think I can ever get it said. There just isn't time." So he said in a taped interview the same year. He died in 1967.

National Collection of Fine Arts

By Storrs L. Olson

A flightless bird, lost and found

The trail of the rail led down into a black hole on Ascension Island, a barren volcanic way station of the mid-Atlantic

Ascension Island thrusts 2,817 feet up above the tropical South Atlantic Ocean, the tip of a volcanic cone in the vast undersea mountain range known as the Mid-Atlantic Ridge. Few pieces of land in the world are so isolated.

From Ascension it is about 1,000 miles to Africa, 1,200 miles to South America. The closest dot on the map is 700 miles southeast, the remote island of St. Helena, which was Napoleon's last prison. Ascension was discovered by the Portuguese in 1501 but men shunned its dry, barren ground until the British installed a garrison there in 1815 to deter any attacks on St. Helena during Napoleon's detention.

Still a Crown possession, the 34-square-mile island is now the site of two British communications stations, a U.S. Air Force base and a NASA tracking station. In addition, but without the benefit of such elaborate technology, sea turtles somehow navigate all the way from South America to lay eggs on Ascension's beaches, and tremendous numbers of seabirds gather from the ocean's reaches to nest there.

Ascension became especially interesting to naturalists when it was discovered that a colony of nearly a million sooty terns, which lay their eggs on the main island, commence breeding every nine months instead of the more usual twelve. But since the arrival of man and the rats, cats and so forth which go with him, the other species of seabirds that once nested on the island in profusion have been forced to retreat. On Boatswainbird Islet, a white monolith of volcanic rock about a quarter of a mile off the eastern shore of the island, one still finds myriads of boobies, noddy terns, tropic birds and frigate birds. Except for four species introduced by man (partridge, myna, waxbill finch and canary), there are no land birds on Ascension—at least no longer.

In 1656 a traveler by the name of Peter Mundy visited Ascension and noted in his journal:

"Att evening wee arrived att Ascention and anchored on the NW. side of the iland. . . . Some of our company went up and broughtt downe six or seven goates, doubtlesse att first left there by the Portugalls: allsoe halfe dozen of a strange kind of fowle, much bigger then our sterlings . . . collour gray or dappled, white and blacke feathers intermixed, eies red like rubies, wings very imperfitt, such as wherewith they cannott raise themselves from the ground. They were taken running, in which they are exceeding swift, helping themselves a little with their wings . . . shortt billed, cloven footed, thatt can neither fly nor swymme. It was more then ordinary dainety meatt, relishing like a roasting pigge."

Mundy's sketch, the only one, of his "fowle."

The bird in Mundy's description sounds like some sort of flightless rail. Rails (like their close relatives gallinules and coots) are usually marsh birds of secretive habits. Over the millennia, numerous species have been blown by chance storms to remote islands where often they survived, multiplied and, usually in the absence of predators, gradually lost the power of flight. But no such bird lives on Ascension today, and it was thought by some that Mundy's description

With a Smithsonian grant, Storrs L. Olson (left) reconstructed this skeleton of a rail. He is writing his doctoral dissertation on the rail bird at Johns Hopkins University.

A flightless bird

might apply to young sooty terns even though these have webbed feet, brown eyes and are hardly exceedingly swift.

Then in 1958, a team of British ornithologists went to study the breeding habits and ecology of Ascension's seabirds. Informed of some bird bones found at the bottom of two volcanic vents north of Sisters Peak, one of the island's high cinder cones, they explored these fumaroles, as they are called, and picked up skulls for identification.

Only later, at the British Museum, was it discovered that one of the skulls belonged to a small rail, but without the rest of the skeleton there was no way to know for sure if this was Mundy's bird. It was never given a scientific name in the hopes that the rest of its remains might sometime be uncovered. But no one returned to look for the rail bones: Ascension is a difficult place to reach.

The author heads for the volcanic cone where British ornithologists had found some bird skulls.

I had been trying to get there for four years when, in late 1969, the Smithsonian's Museum of Natural History and the Oceanography Program sponsored a collecting expedition on Ascension to be conducted as part of my graduate research at Johns Hopkins University. In June 1970 I boarded a U.S. Air Force C-141 cargo plane bound for Ascension. Aboard the plane I met a Carl Coggins, an American who was working on Ascension and who promised to lend a hand. On the island, I was met by Major Jack Couch, the Air Force base commander, who also volunteered to help.

The next day Carl managed to acquire a truck and we drove down a dusty road out to Sisters Peak. On either side of the road were mounds of brown lava and clinker, almost totally devoid of vegetation. Most of Ascension's plant life has been brought in by man, yet even today the northwest side of the island is largely barren of signs of life save for a few lichens and sprigs of dry grass.

Into the graveyard on a frayed rope

We parked the truck at a cinder quarry and took off on foot across the loose cinder hillside and craggy lava flows. After several hours of wandering around, poking into crevices and crawling into tunnels hung with jagged "lavacicles," we came upon the two fumaroles. The two low cones looked like gobs of mud just erupted from the earth and solidified shortly before our arrival. But no volcanic activity has been reported on Ascension since its discovery. We climbed up the crumbling lava to the rim of one fumarole. We peered down the gaping hole but it was late and we lacked climbing equipment, so we returned to the truck.

The next morning we returned to the fumaroles. After much discussion, and much hesitation (especially on my part), we secured a rope around a mound of lava and Jack went down. I followed, and a shower of loose clinker rained down around me. At the bottom was a dim chamber with a passageway which we followed into another chamber. Through the roof of the second chamber we could see another opening to the fumarole which, we decided, would be our entryway on subsequent visits.

On the far side of the second chamber, near the roof, was a narrow crevice. Jack climbed up and went through, reporting that at the end of the crevice was a drop of 10 or 12 feet into another chamber. We found an old frayed rope, perhaps left by the British 12 years before, and Jack let himself down. I lowered a flashlight and a cotton-filled box to him on a string, the latter in case he should find some specimens. Be-

fore long he called out that he had found some small bones in one corner of the chamber and, packing them in the box, he sent a few up carefully.

They were indeed the bones of a rail, mostly leg bones but with one wing bone that was proportionately very small. Jack picked up a few more bones among which were portions of two breastbones, both quite flat and definitely showing that the diminutive bird had indeed been totally flightless. There was no question in my mind but that this was Mundy's rail. There were many more bones still remaining, but thirst and heat had taken its toll for the day, and we decided to leave.

Three days later Jack and I returned to the fumarole and climbed down the narrower but more direct entrance. This time I accompanied him through the crevice and down the frayed rope into the last chamber. In a depression in one corner of the vault hundreds of small bones were scattered about. As it turned out, at least 32 birds had died in this graveyard of flightless rails. Doubtless the birds had fallen into the fumarole and, being unable to fly out, had wandered into the farthest recesses where they died.

It seems likely that the Ascension rail survived by eating the eggs and regurgitated food of seabirds and possibly the carrion beetles that feed on the inevitable carcasses associated with large bird colonies. Then man brought his rats and cats which most likely preyed on the rails and their eggs, as well as extirpating the seabirds which were the rails' source of food. The rail population was doomed.

A respectable little bird

I made two more trips into the fumarole. On the last, with Douglas Rogers, the curator of the Ascension Historical Society Museum, we recovered an intact skull: I had now all the elements of the skeleton —more than enough for a formal scientific description of the species. During my month on the island I collected other animal and mineral specimens, including a bonus of at least five species of shrimps and crabs unknown to science. These are now under study in the Smithsonian's Department of Invertebrate Zoology.

Now back at the museum I am poring over the dry relics of a long-dead bird. Among the world's priorities, the bones before me have perhaps very little significance, yet I cannot help but feel an infinite respect for this little bird. At some time in the past its ancestors crossed more than a thousand miles of open ocean to land on one of earth's harshest landscapes. In a new and hostile environment, it quickly adapted and for a while survived. But now what was once a tribute to the tenacity of life must be reckoned as one more memorial to the destructive thoughtlessness of man.

Fearfully, he says, the author lowered himself into a series of caverns in a volcanic cone.

By K.C. Tessendorf

The controversial 'noxious weed'

Revered, despised, honored, reviled, fashionable, foolish and now dangerous, tobacco is nonetheless still with us

"Ye hot, ye cold, ye Rheumatick draw nigh;
In this rich leafe a sovereign dose doth lie.
We'll cure ye all: Physick ye need not want,
Here 'tis, i' th' gummy entralls of a Plant."

Columbus, stepping ashore after his discovery, met gentle Arawak Indians whose simple gifts included dried brown fragrant leaves. The perplexed Spaniards later threw them away. Yet the natives of San Salvador thought this a rich present for their visitors.

Tobacco was the New World's most startling gift to the Old, resulting in folklore, discussions and controversies from then on up to the linkage of cigarettes with lung cancer. Indian usage of the herb in tropical America was typically heavily addictive. Spanish-historian Oviedo noted: "...They would inhale the smoke [through a Y-shaped tube in their nostrils] until they become unconscious and lay sprawling on the earth like men in a drunken slumber." In modern parlance, they got stoned.

Self-induced narcosis was refined upon in the higher culture of the Mayas where tobacco was also drunk. In quasi-religious ceremonies the celebrant quaffed a modest measure—lest he pass on instead of out—of a broth of sugarcane pulp, tobacco, roots, in which live turtles had been boiled. A hallucinatory state was achieved in which spirits, prophecies, and sublime feelings abounded. Since the Indians believed these properties of tobacco were divine, this was good.

Explorers like Hawkins, Raleigh and Drake are credited with introducing smoking, in milder form, into Europe. Certainly the first users were braggart seamen amazing the populace of port towns by parading about with smoke eddying from their nostrils:

"A certain Welchman coming newly to London, and beholding one to take tobacco, never seeing the like before, and not knowing the manner of it, but perceiving him vent smoke so fast, and supposing his inward parts to be on fire; cried out: 'O Jhesu, Jhesu man, for the passion of Cod hold, for by Cod's splud ty snowt's on fire,' and having a bowle of beere in his hand, threw it at the other's face to quench his smoking nose."

Catherine de' Medici of France treated her headaches by snuffing tobacco procured through Jean Nicot, the French ambassador at Lisbon. The word nicotine is derived from his name.

Tobacco was hailed as a cure-all for ills ranging from "humidities of the head," weak sight, loathsome boils, to yes—cancer. Dutch physician Jan van Beverwijk prescribed: "It has a tendency to promote dessication . . . it turns the stomach and loosens the bowels and causes violent convulsions throughout the body. . . . Tobacco should be taken early in the morning, on an empty stomach—not by children . . . or by those mentally deficient or by those who have high blood-pressure." Much praised was the tobacco-smoke enema, in use until about 100 years ago. It was believed tobacco users escaped London's Great Plague, and even children were forced to smoke at school.

Queen Elizabeth's miseries

Tobacco became fashionable. When Sir Walter Raleigh personally introduced smoking to Queen Elizabeth I, he shared a queasy moment with her. She lost her lunch. Bystanders began to murmur of poison, but Bess commanded all ladies present to smoke and share the consequences.

There appeared, however, some determined opponents, including Elizabeth's successor, James I. In his *Counterblaste To Tobacco* he spoke out with majestic vigor: "A custome lothsome to the eye, hateful to the nose, harmfull to the braine, dangerous to the lungs, and in the black stinking fume thereof, nearest resembling the horrible Stygian smoke of the Pit that is bottomlesse. . . ."

Still the custom prevailed, and swelled, bringing early, enduring prosperity to the North American seaboard colonies. At first the leaf was smoked in

K.C. Tessendorf's stories on ballooning and hair styles appeared in SMITHSONIAN *in September and January. Arnold Roth illustrated the Blaine Society article in September.*

The New World's most startling gift to the Old.

pipes, but snuff-taking spread from France to overwhelm England in the 18th century. Cigars, inhibited by price and tariffs, expanded slowly from Spain, but were early popular in America.

Snuff-taking was considered the best way to absorb the therapeutical qualities. This generation greatly feared being internally obstructed to death, and the tobacco dust laid upon the back of the hand and drawn into the sinuses with a gentlemanly snort was presumed a great cobweb cleaner:

"Do but notice what grimaces snuff-takers make, how their features are convulsed, how they dip into their snuff boxes in measured rhythm, cock up their noses, compose their mouths, eyes and all their features to a pompous dignity. . . . In the moment when they sniff the snuff up their noses, they are men inspired, transformed into mighty kings and princes, or at least made royal and princely at heart."

An Englishman invented a snuff pistol which drove a sufficient quantity up the nostrils to last the whole day. Anti-snuffite "grave doctors" declared the autopsied brains of snuff-takers were clogged with soot.

As the custom of smoking spread throughout the world, the first prohibitions were attempted. Noxious fumes and dropped ashes prompted Pope Urban VIII to ban smoking in church (1624) on pain of excommunication. In Russia, bedtime users were blamed for conflagrations, and smoking was forbidden for a time. Penalty escalated per offense: flogging, nose to be cut off, life forfeited. An Eastern potentate outlawed tobacco on grounds it sapped virility and so cut the birthrate, and Persian pushers were roasted upon their merchandise.

Near the beginning of the 19th century an indelicate offshoot began to make headway in England. A pious writer complained that ". . . Kneeling before the Supreme Being . . . is rendered in many seats impracticable, because of the quantity of Tobacco saliva, which is ejected in all directions." Chewing, however, attained its principal success in America where a wag proposed the spittoon as our national emblem.

The humble cigarette had long been lurking in Spain and France, and came marching back to England from the Crimean War. For some decades it was roll-your-own plaything of one-handed virtuosos—"twist a dizzy"—but in 1884 American ingenuity produced the cigarette machine of James Bonsack which produced 100,000 cigarettes per day per unit, and Madame Cigarette was on her way toward overwhelming the tobacco market.

Meanwhile medical science mounted a spirited if scattered attack on the physical evils of tobacco. In 1856-57 the pages of British medicine's *The Lancet* were enlivened by doctoral controversy with one physician casually fingering tobacco as a factor in nervous paralysis. While some defended smoking as harmless or mildly beneficial, others brought the weed to book for causing typhus, abetting typhoid

"It has a tendency to promote dessication. . . ."

". . . Notice what grimaces snuff-takers make. . . ."

fever, promoting alcoholism and spreading syphilis.

In the United States, though plebian cigarette smoking was rampant, it was slow in attaining respectability. A common expression was: "And next thing you know, he'll be smoking cigarettes." In the early 1900s a sustained and virulent campaign, based on moral and physical principles, was mounted.

Henry Ford called cigarettes "little white slavers," and some industries refused to hire the smoker "because he is a defective who will drag anyone he can clutch with his nicotine fingers beneath the wave with him." The great and manly John L. Sullivan loosed a chauvinistic blast upon the cigarette:

"Who smokes 'em? Dudes and college stiffs—fellows who'd be wiped out by a single jab or a quick undercut. It isn't natural to smoke cigarettes. An American ought to smoke cigars, an Englishman a briar, a Harp a clay pipe and a Dutchy a meerschaum. It's the Dutchmen, Italians, Russians, Turks and Egyptians what smokes cigarettes, and they're no good anyhow."

In laboratories, morally motivated doctors labored to prove smoking caused retardation, criminality and heredity damage among the young. The press sometimes abetted their cant:

"CIGARETTES MADE HIM A LUNATIC

Bright school-boy becomes chattering beggar.

Made mad by smoking. Danced, raved, prayed."

At the high-water mark of hysteria, cigarettes were banned ineffectually in 14 states and the U.S. Navy.

Dr. John Harvey Kellogg, an American surgeon, associated tobacco use with deafness, acne, diabetes, arteriosclerosis, oral cancers and heart disease. When it came to *women smoking,* some doctors verged on bathos. Nicotine in Mother's milk!

There were warnings of scrambled hormones which would induce mustaches on the fair sex. As late as 1936 a physician declared flatly: "A baby born of a cigarette-smoking mother is sick. It is poisoned, and may die within two weeks of birth. . . . Sixty percent of all babies born of mothers who are habitual cigarette smokers die before they are two years old."

The general public shrugged and read the cigarette ads instead. Grown wealthy and powerful during World War I, the cigarette industry counterattacked with relish. Ladies aspiring to flapper silhouettes were counseled to "Reach for a Lucky instead of a Sweet." They summoned physicians to testify their personal preferences and give opinions on irritation levels. Opera and popular singers said they smoked to soothe their throats. Remember "Not a cough in a carload"? The desirability of smoking was attested by every conceivable type of public idol. The habit rolled on into the 1960s with 500 billion cigarettes produced to win 80 percent of annual tobacco sales.

In 1964, medical science, armed primarily with statistical evidence, convinced the federal Surgeon General that cigarette smoking is hazardous to the health and related to lung cancer.

Dr. Samuel Johnson spoke out crisply two centuries ago: ". . . It is a shocking thing, blowing smoke out of our mouths into other people's mouths, eyes, and noses, and having the same thing done to us."

Surely to the uncommitted this is an eminently reasonable statement. But the committed are a great host, and Man is slow to forego mildly addictive, mildly narcotic habits which enjoy broad social acceptance. Just now perhaps a million smokers are quitting each year while perhaps a million youngsters are taking on the habit. About 36 percent of adult Americans are smokers. The end is not nearly in sight along Tobacco Road.

"A baby born of a cigarette-smoking mother is sick."

Book Reviews

Our Times:
The Turn of the Century (1890s-1903)
America Finding Herself (1904-1905)
Pre-War America (1905-1908)
Mark Sullivan
(Scribner's, $17.50 per volume)

Our Times was published over a period from 1926 to 1935 in six large volumes which became a classic record of life in the United States from the 1890s to 1930, presented as a social and political history which has remained unrivaled.

The first three volumes have been reissued and the remaining three volumes will follow later this year. It is a commentary on "Our Times" (today) that the price of each of the volumes is more than triple the original cost.

Each volume is profusely illustrated with from 200 to 250 linecuts and halftones: newspaper cartoons and comic strips, fashion sketches and advertisements, posters, book illustrations and photographs of contemporary figures and concerns garnered from a wide range of publications of each period involved.

The purpose of the narrative, according to the author in Volume I, was "to follow an average American through this quarter-century of his country's history, to re-create the flow of the days as he saw them, to picture events in terms of their influence on him, his daily life and ultimate destiny. The aim is to appraise the actors of history and their activities according to the way they affected the average man."

What Sullivan achieved is less a connected narrative than a compilation of the raw materials of history woven into a panorama of the period. Nothing was too great or too small for consideration; facts were presented without argument; a work was produced that is as entertaining as it is stimulating and suggestive. Sullivan brought to his task his many years of experience as a lawyer and newspaperman and a style derived from his profession which was vivifying and actual and remains so to this day. *Our Times* achieves a summary of American life that is packed with color and action.

A major virtue of the work is the relationship between main currents—social, economic and political—and the trivia of everyday living. Quotations from contemporary poetry and musical lyrics, excerpts from periodicals, attempt, as Heywood Broun stated, to provide not only a bird's-eye view but also a worm's-eye view of the surface manifestations of this first quarter of the 20th century. The author's concern with popular preoccupations from tastes in pets, to the advent of the Gibson Girl, effectively help to reconstruct much of the outlook of the period.

The first volume, *The Turn of the Century,* describes life in the 1890s and the first three years of the new century. Volume II, *America Finding Herself,* takes the reader into a study of cultural, social and economic aspects of the years 1904 and 1905 but with flashbacks to the Civil War. Here is a chapter on the crusade for pure food. The volume ends with the advent of the airplane, as the first volume ended with the emergence of the automobile. The content of *Pre-War America,* Volume III, is limited somewhat specifically to the second part of the first decade of the new century, concerning itself primarily with the Presidency of Theodore Roosevelt. This volume ends with the impact of the movies on American life.

Reviewers found little to criticize in these volumes when they first appeared. It is true that Sullivan made little if any attempt to provide historical analysis, and his materials were frequently loosely connected and badly digested. His sustained enthusiasm and vivid visualization of incidents, however, and the massive supportive detail rendered his series an unparalleled source work for historians, students and general readers. Read again 35 to 40 years later, *Our Times* reveals itself as a work of greater-than-ever value and interest.

—Silvio A. Bedini

Henri Mercier
and the American Civil War
Daniel B. Carroll
(Princeton, $12.50)

Two themes are skillfully entwined in this treatment of a Civil War diplomat from the Second Empire. The first theme, poetic and patriotic from the American viewpoint, has to do with the defiant indestructibility of the Federal Union.

The second theme, often elided by historians, concerns the watchful waiting of European buzzards, notably France and Britain, which intended to pick our nation's bones if we failed to survive.

This double development is seen through the eyes of a sophisticated French diplomat, Henri Mercier (1816-1886) who was Emperor Napoleon III's minister in Washington from the summer before Lincoln's election until the time of certain of Lincoln's triumphs after Gettysburg and Vicksburg, and the Union's firm lease on life. Dr. Carroll has given us an erudite biography. It may not be for everybody, but its detail is rich, and it thoroughly deserves the Gilbert D. Chinard Prize awarded in 1968 by the Society for French Historical Studies when the work was still in manuscript.

Mercier watched Lincoln's inaugural with little comprehension of its portentous nature. He was a handsome, pleasant man, with close friendships among the social elite, such as the old Washington families of Corcoran and Riggs, but with a low opinion of democracy and of

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the gauche new President whom Mercier considered a total ignoramus in foreign affairs. Actually, as history evolved, the elegant Frenchman turned out to be a much slower learner than the rail-splitter.

Dr. Carroll is a favorable biographer, but he several times notes that Mercier never got over the misconception that the adjective "American" applied only to economic affairs. The minister's main sphere of concern was with the Southern cotton trade, the tariffs at the Northern ports and his Emperor's Mexican policy of enthroning the satellite ruler, Maximilian of Hapsburg. Mercier's attention to these affairs should have taught him that any economic definition of what "American" means was entirely insufficient, for there were no takers when he tried to wheel and deal. He could not, writes his biographer, accept the "most compelling fact" that Americans "cared more about national wholeness than they did about prosperity, or even life for that matter."

In fairness to Mercier, however, he was in the vast majority of hearers and readers whose understanding of the Gettysburg Address was less than instantaneous. Lincoln's brief and inspired message constituted a baptismal ceremony for American nationalism, and this was a fact of supreme importance to citizen and alien alike. But until some time after Lincoln said so, few were aware that the great battles were deciding whether this government or any government conceived in liberty, should perish from the earth.

It would be wrong to condemn Mercier for lack of perception. As French minister, he had a single-minded devotion to French interests, and his job was complex. He had been born in Baltimore of consular parents, and was temperamentally a Southern sympathizer. But he was also a humanitarian who abhorred slavery and who knew that public opinion in France supported this view. Yet France as well as Britain stood to gain by a partition of the Union, and to this purpose Mercier incessantly schemed.

He dickered to bring about a negotiated arrangement that would retain slavery and that would form a common market with trade opportunities for Europe. He tried to pick the ripe moment for a Franco-British recognition of the Confederacy as a belligerent power, and thereby to gain mercantile access to the blockaded cotton ports.

Mercier may even have been playing the double agent when he accepted Secretary of State Seward's offer of safe conduct to visit Richmond in the spring of 1862. Seward undoubtedly wanted him to undermine Confederate morale with hints of a forgiving peace-with-reunion. Mercier probably (but this is inferential guesswork) encouraged the Southern statesmen with hints of European intervention.

This intervention was never mounted, but no spirit of altruistic restraint held it back. The factor that discouraged a Franco-British incursion, according to Dr. Carroll, was the healthy fear in Europe of President Lincoln and the burgeoning American nationalism. A government that was tough enough to carry on an immensely unpopular and seemingly unwinnable war was not a power to be trifled with. The hands-off policy of Paris and London was actually made in Washington.

Mercier's intrigues finally made him unacceptable both to Lincoln and Seward, and therefore of lessening use to Napoleon III. The minister left for home in December 1863, ostensibly "on leave" but with no desire and no encouragement to return. He learned of Lincoln's assassination while serving in Spain and wrote a touchingly sincere letter of condolence to Secretary Seward. Mercier's own career ended with the fall of Napoleon III in the Franco-Prussian War of 1870-71.

A ship that passed through American diplomatic waters in the night was Henri Mercier, but one that carries a quiet fascination for modern observers of the ways of nations.

—Holmes Alexander

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South America: A 21-day tour of Colombia, Ecuador, Peru and Brazil with emphasis on archaeological sites, architecture and museums—August 4-25.
"No-Tour" Tour: Dulles to London, September 9-30—waiting list only.
Soviet Union: An unusual tour that includes Samarkand, Kiev, Vladimir and Novgorod. Second section—October 25-November 19.
Tours—1972 (Details later.)
Mexico and Guatemala—January 3-22.
St. Croix, Puerto Rico—February 1-14.
Australia and New Zealand—Late March-April.
"No-Tour" Tour: Dulles to Paris—May 29-June 19.
Greece, Yugoslavia—June 15-July 8.
"No-Tour" Tour: New York to Frankfurt—July 3-24.
King Arthur's England—July 12-August 2.
The Pilgrimage Road—September 11-October 9.
"No Tour" Tour: Dulles to London—September 11-October 2.
Pakistan and Afghanistan—October 10-November 15.

Domestic Tours

Paleobotany Collecting in Nova Scotia: A collecting-and-study trip to the fossil-bearing coal seams and high tidal flow area at Joggins—June 21-26.
Apollo 15 Space Launch: A four-day trip to witness the launching of Apollo 15 to the moon. Tour includes NASA facilities—July 23-27.
Cascade Volcanoes: An inspection tour of the recent geologic history of Mt. Hood in Oregon and Mt. St. Helens in Washington. This will include vigorous climbing.—August 9-17.
Photography and Nature: A tour of Moosehorn Wildlife Refuge in northeastern Maine, with advice on photography—September 7-12.

Smithsonian highlights

National Portrait Gallery
"Portraits by Winold Reiss" is a unique pictorial commentary on the important role black Americans have played in shaping this nation's art.

"Mary McLeod Bethune" exhibit includes portraits, photographs and memorabilia of this founder of the National Council of Negro Women and member of Franklin Roosevelt's Black Cabinet—June 18-25.

"'A Glimmer of Their Own Beauty': Black Sounds of the Twenties" focuses on blues, jazz and poetry with a period jukebox, films and readings reflecting black life in the Twenties. Opens June 15.

National Collection of Fine Arts
"150 Years of American Drawing (1780-1930)" includes 55 drawings from the collection of John Davis Hatch, authority on the works of American draftsmen.

"John Marin (1870-1953)" is a centennial exhibition of his works, including 157 oils, watercolors, drawings and etchings, organized by the Los Angeles County Museum of Art.

"Junior High School Art" replaces the "High School Graphics II" in the education gallery and represents the best art offered by the District of Columbia junior high schools. June 15-28.

"Hidden Aspects" is an exhibition of diverse treasures belonging to the National Collection but not usually on view and includes tours of behind-the-scenes facilities during an open house on June 27.

Museum of Natural History
"Japanese Arms and Armor" features distinctive weaponry used in Japan from the 4th century to the 19th century when Western weapons were introduced. A prize-winning film supplements the show.

Physical Geology Division has opened the first section of their hall which features a giant geologic world globe.

Fiber glass use and techniques in preparing realistic displays are demonstrated in the foyer.

Museum of History and Technology
This building will be open from 10 A.M. until 9 P.M. daily from June 14 through Labor Day.

"Soup Tureens" collected by the Campbell Soup Company including porcelain and silver antiques go on display June 15.

"Music Machines—American Style" features the music-making machines that have revolutionized the performance, reproduction and dissemination of music in this country. There will be live performances, lectures, recordings and movies shown continuously.

"Poetry of the Body" is a collection of paintings of parts of the body by Dr. Paul Peck. They are both medically accurate and visually appealing.

"Do It the Hard Way: Rube Goldberg" is an exhibition of cartoons, sculpture and inventions (see SMITHSONIAN, November 1970).

Anacostia Neighborhood Museum
"Exhibition 71" includes the work of 36 D.C. artists in this third annual event sponsored by the D.C. Art Association.

Freer Gallery of Art
"Chinese Album Leaves and Lacquer Ware" is a collection of 24 painted album leaves dating from the Sung through the Ch'ing dynasty. Also included are five examples of Chinese lacquer ware that represent the change in style from 1280 A.D. through the late 15th century.

"Japanese Screen Paintings" include bird and flower screens from the Freer collection ranging in date from the late 15th century to the 18th century.

Arts and Industries Building
Apollo Lunar Module now on display is a flight-weight, operational, back-up lunar landing craft. The moon rock, weighing slightly more than a pound, is the largest remaining sample from Apollo 11. The Apollo exhibit is expanded to include Apollo 12 flight suits, the lunar rock box and surface tools used by Apollo 11 astronauts on the moon.

The Robert H. Goddard Memorial Exhibit includes his 1926 and 1941 rockets and assorted memorabilia.

"Space and Artists" consists of 60 works of art inspired by the space effort.

Division of Performing Arts
"The Waywardly Wandering Wagonful of Banjo and Jack" features the Smithsonian puppet theater created by the Allan Stevens company. The show is based on the old touring wagons that traveled across the country in the 19th century and includes folk stories and songs. Daily, Wednesday through Sunday —Museum of History and Technology.

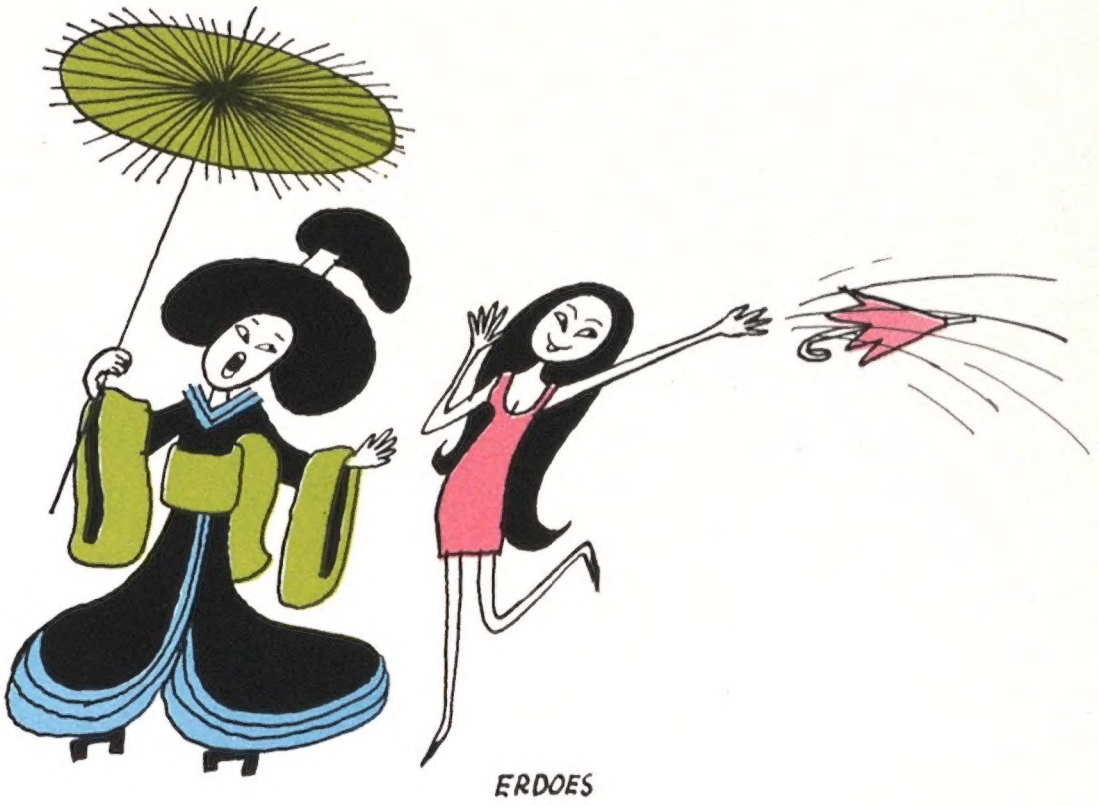
American folk music concert cosponsored by the Folklore Society of Washington—in the Museum of Natural History Auditorium—June 11. (For further information on tickets, call 202-381-5395.)

Traveling Exhibition Service
Mobile, Alabama—"The Hand of Man on America" photographs by David Plowden (Mobile Art Gallery, June 10-July 9).
Greenwich, Connecticut—"Tibetan Carpets" (Bruce Museum, June 12-July 11).
Jackson, Mississippi—"The Genteel Female" (State Historical Museum, June 5-July 4).
Elmira, New York—"Art of John Held jr." (Arnot Art Gallery, June 5-July 4).
Johnson City, Tennessee—"Contemporary American Black Artists" (Carroll Reese Museum at East Tennessee State University, June 20-July 19).

Smithsonian Commons
Luncheon facilities are now open for staff, resident scholars and all members of the Smithsonian Associates. Located in the original Smithsonian Building and open weekdays from 11:30 to 2:00 o'clock, the Commons offers a complete buffet luncheon for $2 or a salad for $1.25 upon presentation of a membership card.

By Patrick Ryan

Bumbershoots or brollies—they are now disposable



To every thing there is a season, saith the Preacher, and a portent from Japan suggests that autumn may be setting in for the elegant umbrella. A Tokyo firm has lately made an experimental marketing of a throwaway umbrella fashioned—without any metal parts—from water-repellent paper. It opens up like an orthodox model, yet collapses down to package-size to fit unseen into pocket or handbag. Since it was priced at around 25 cents, with a promise of further reduction if it went into mass production, there is the prospect for all but the thriftiest of tossing away the *parapluie* when raindrops stop falling on our heads.

Contemplated intently, our traditional umbrella is among the most impressive and durable of the personal artifacts of man. And there are strains of magic in its unique capacity to lie at rest like a thin, black goose and then to blossom under rainfall into a domed, ebony flower. A current dictionary definition as "a portable shelter with a sliding framework of ribs on a stick" still describes a technical design which, on the evidence of ancient Egyptian reliefs, hasn't changed in basic structure for some 3,000 years.

Originally an insignia of nobility, our pluvial protector is thought to have been first conceived as a mobile tree, symbolic of the sacred trees under which primitive potentates deemed their dooms. The Kings of Siam, long before Anna, held audience under a four-storied version; the ranks of Chinese mandarins were indicated by the brilliance of their official brollies; and the Doge of Venice never went down to wed the sea without the cover of his splendid parasol.

Literary tributes include the record that one of the first essentials that Robinson Crusoe made for himself was an umbrella of goatskins with the hairy side out, the better to bear off the rain. And with such success that the old trade name for those vast water-shedders wielded by doormen of upper-crust hotels was a "Robinson." Dickens took over from Defoe, however, and put the word "gamp" into the English language by creating in *Martin Chuzzlewit* the disreputable and mercenary nurse Sarah Gamp, who was ever accompanied and eponymously immortalized by her large, flapping umbrella. And, more recently, Mary Poppins has emphasized for all to see the value of a good gamp for all governesses with aeronautical ambitions.

In martial history, even though the Spanish army was somewhat derided for sensibly going to war with umbrellas on the alert, the fashion later spread to the British army. At the Battle of Bayonne in 1813, the Duke of Wellington soundly reprimanded the officers of the Grenadier Guards for riding into battle with one-legged wigwams aloft to protect their gorgeous plumage. Though Guards officers today still carry exquisitely rolled umbrellas when in civilian clothes, by tradition they never unfurl them in public—perhaps because they are still in fear that if they do so, the Iron Duke will rise up from his tomb in St. Paul's and give them another bawling-out.

The perfectly rolled umbrella has become accepted overseas as the emblem of the British gentleman, and particularly of London "City gents." Something unhealthily obsessive in the national character is possibly revealed by the fact that only the British know how to roll brollies into elegant tapers, while all other nations carry their gamps around like dead, black flamingos. A tightly rolled umbrella could also be considered appropriate to the British racial outlook, since it is useful for pointing patronizingly at foreigners, poking into suspicious packages left by colonial ill-wishers, and serving as an emergency sword stick for fending off the attentions of riotous tea-dumpers.

It is too early yet for anthropologists to forecast whether, if the Japanese pocketable umbrella becomes the vogue, the loss of the present arrogant prop will lead to the emergence of anything more lovable in the Anglo-Saxon character. A major labor problem may arise when gamps can no longer be left behind in trains and buses, and unemployment hits all those worthies who now collect them.

But it is certain that literary fame will then be finally over for the wit who paraphrased a famous passage from St. Matthew in observing that "the rain it raineth on the just,/and also on the unjust fella:/But chiefly on the just, because/the unjust steals the just's umbrella."

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